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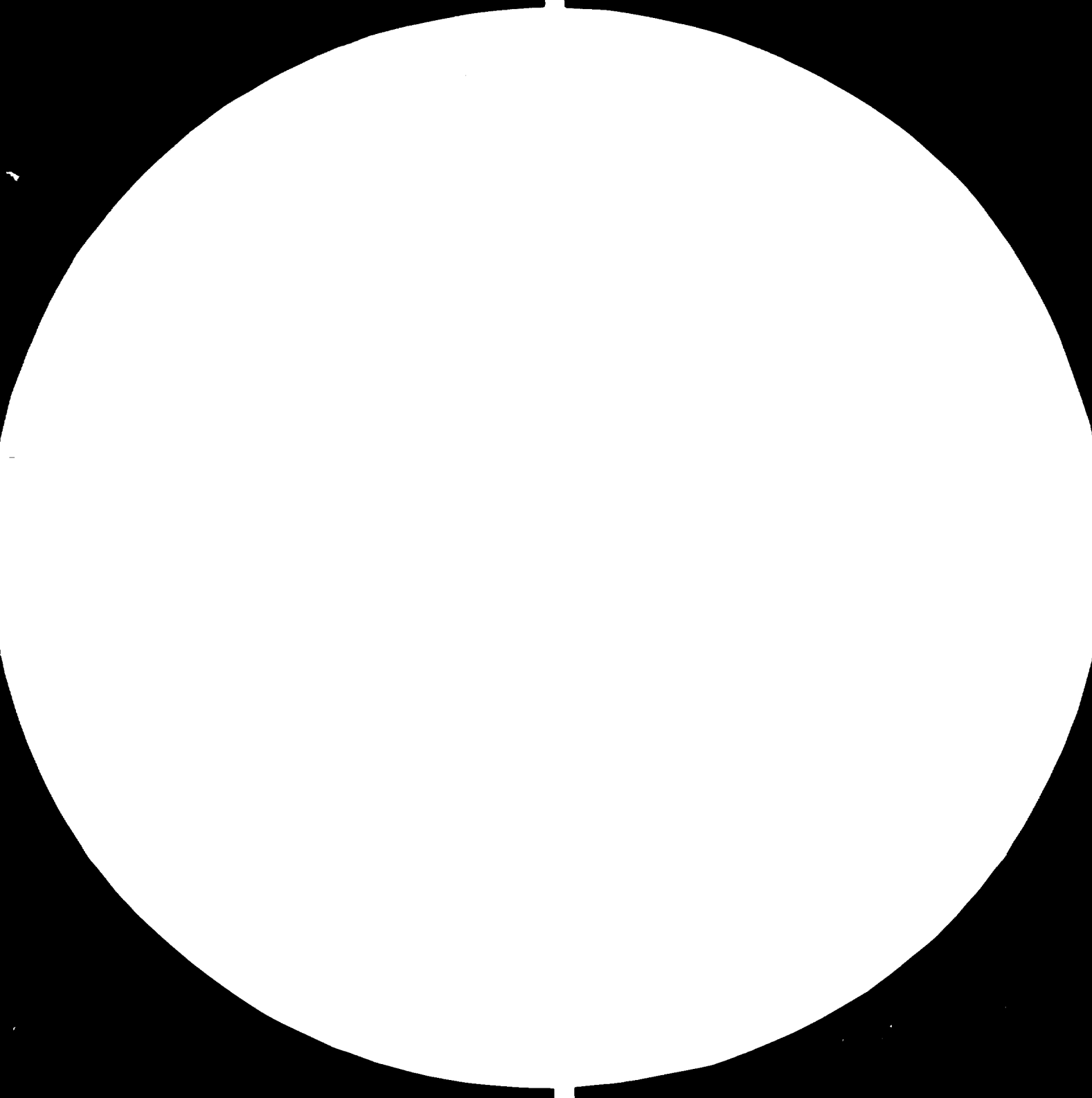
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MICROCOPY RESOLUTION TEST CHART

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PRE-FEASIBILITY STUDY

ON

FRUITS AND VEGETABLES CANNING UNIT

IN RAJSHAHI, BANGLADESH

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~~BANGLADESH~~

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DACCA : OCTOBER 1978

(i)

PRE-FEASIBILITY STUDY
ON
FRUITS AND VEGETABLES CANNING UNIT
IN RAJSHAHI
FOR
BANGLADESH SUGAR AND FOOD INDUSTRIES CORPORATION,
DACCA.

DACCA, OCTOBER 1978.

SK/PG/NA.

(ii)

The author of the Pre-Feasibility study:

Jiri V. Skala, Dipl. Tech., Food Industry Specialist
to United Nations Industrial Development Organisation
in Vienna in cooperation with :

Dr. N. M. Sheikh, Chief of Planning & Development,
BSFIC, Dacca

and

A. F. Badrud-Doza, Chemist, BSFIC & Local counterpart
of the Specialist.

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(iii)

Quantities - Weights - Measures

1 Acre	=	4,840 Square Yards = 0.404 ha
1 Lalh	=	100,000
Tk. 15.00	=	1 US \$
1 lb	=	16 oz = 453.59 g
1 oz	=	28.349 g
1 Long Ton	=	2,240 lbs = 1016.04 kg
1 Maund	=	82.2 lbs = 37.285 kg

Used abbreviations

PEP	=	Project Evaluation Proforma.
BSB	=	Bangladesh Shilpa Bank.
ECNEC	=	Executive Committee of National Economic Council.
BSRS	=	Bangladesh Shilpa Rin Sangstha.
FRG	=	Federal Republic of Germany
Ch.H.T.	=	Chittagong Hill Tracts.

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...../

Institutions and Research workers interviewed:

1. Horticultural Base Kashia Danga - Rajshahi Court.
2. Bangladesh Agricultural Development Corporation, Rajshahi.
3. Agricultural Statistic Office, Rajshahi.
4. District Extension Officer in Rajshahi.
5. Senior Scientific Officer - Agricultural Research Sub-Station, Kazla, Rajshahi.
6. Division of Food Technology and Nutrition, BCSIR Laboratories, Dacca.
7. Associate Director Mr. Kamaluddin Ahmed, Agricultural Research Institute, Dacca.
8. Mr. A. S. M. Kamaluddin, Director, BSFIC, Dacca.
9. Dr. M. A. Rahman, Food and Nutrition Research Division, BCSIR Laboratories, Dacca.
10. Argosy Conserves, Dacca.

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C O N T E N T

USED ABBREVIATIONS

QUANTITIES - WEIGHTS - MEASURES

REFERENCES

INSTITUTIONS AND RESEARCH WORKERS INTERVIEWED

1. INTRODUCTION

PROJECT PROMOTER

LOCATION OF PROJECT

PROJECT BACKGROUND

STUDIES AND INVESTIGATIONS ALREADY PERFORMED

THE LATEST STAGE OF THE PROJECT

2. LOCATION AND SITE

LAND SURVEY

LOCATION

ACREAGE DEMANDS

3. ANALYSIS OF MATERIAL RESOURCES:

AGRONOMICAL & STATISTICAL DATA

HARVEST DIAGRAMME OF FRUITS AND VEGETABLES

CLIMATIC CONDITIONS

PLANNED PROGRESS IN THE AGRONOMICAL SPHERE

4. LABORATORY TEST:

ANALYTICAL AND PHYSICAL VALUES OF THE FRUIT

TECHNOLOGICAL FEASIBILITY OF THE FRUIT

5. WATER SUPPLY:

WATER ANALYSIS FROM RAJSHAHI SUGAR MILLS.

...../

6. TECHNOLOGY:

PROJECTED PRODUCTION CAPACITY
TIME TABLE
PRODUCTION SCHEDULE
TIME SCHEDULE
PRODUCTION PARARELLITY
PRODUCTION SCHEMES - 1-7.
SUPPLEMENTARY PRODUCTION SCHEMES - 8-12
LIST OF MACHINERY EQUIPMENT FOR THE PROJECTED PRODUCTION

7. PRODUCTION STANDARDS:

QUALITY STANDARDS FOR READY PRODUCTS
CONSUMPTION STANDARDS

8. CLAIMS FOR QUALITY:

FRUIT
INGREDIENTS
PACKING MATERIAL

9. POWER DEMAND

10. MATERIAL HANDLING:

RAW MATERIAL
INGREDIENTS AND CHEMICALS
PACKING MATERIAL

11. STOCKING:

RAW MATERIAL
COLD STORE
INGREDIENTS AND CHEMICALS
PACKING MATERIAL
READY PRODUCTS

12. PLANT ORGANISATION:

ORGANISATIONAL SCHEME

PRODUCTION CAPACITIES

MAN POWER DEMAND

13. LAYOUT OF THE PRODUCTION PLANT:

SPECIFICATION OF THE PRODUCTION BUILDING

14. CONCLUSIONS:

15. ANNEXES:

QUALITY STANDARD FOR DRINKING WATER

LIST OF ADDRESSES COMMUNICATED.

PRE-FEASIBILITY STUDY

Fruits and Vegetables Processing and Canning Unit
in Rajshahi, Bangladesh.

Project Promoter : Bangladesh Sugar and Food Industries
Corporation, Shilpa Bhaban,
Motijheel Commercial Area, Dacca.

Location of the Project : Rajshahi, Bangladesh.

Project Background:

Mango is one of the most delicious fruits of the world. In Bangladesh mango is cultivated on about 100,000 acres of land and its annual production is approximately 260,000 tons. Out of this, 23,905 acres of land are under mango plantation in the district of Rajshahi and the annual production is 106,000 tons of fruit, that is 30% of the total mangoes produced in Bangladesh.

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Beside Mango, Litchi, Banana and other fruits the district of Rajshahi produces remarkable quantity of vegetables, thanks to the favourable soil and climatic conditions.

In the year 1977, Rajshahi district produced on 1,335 acres 3,980 tons of tomatoes, on 1,240 acres 3,735 tons of cabbage, on 1,055 acres 2,985 tons of cauliflower and on 405 acres 980 tons of cucumbers and other vegetables.

Much of this products are spoiled during the time of glut due to the lack of efficient transportation means and possibility to process these fruits and vegetables in canned product. This is a great loss for a developing country like Bangladesh. It is a matter of regret that up till now Bangladesh has not been able to use such natural wealth in order to improve the national economy for further developing the agricultural sphere, unlike other countries. If adequate canning facilities are made available these could be exported on foreign markets like Middle East, Far East, Europe etc. after fulfilling the local market demand.

Apart from these, there will be new employment opportunity for the people of this region.

The project of the BSFIC correspond thoroughly with the policy of the Government to industrialize all parts of the country. For the above mentioned reasons the corporation proposes to set up this industrial unit in Rajshahi Division, as it is an industrially undeveloped area.

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Studies and Investigations already performed

The BSFIC has already performed :

1. The Project Proforma on Fruits and Vegetables Processing and Canning Unit at North Bengal.
2. The project was included into the Two Year Plan 1978 - 80 of BSFIC.

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THE LATEST STAGE OF THE PROJECT:

The former Bangladesh Food & Allied Industries Corporation proposed to set up a Fruits & Vegetables processing unit at North Bengal during the First Five Year Plan of the country to produce 9 tons of product per day for 200 working days in a year using mango, litchi, tomato, etc. as raw materials.

The PEP of this project was submitted on 25-7-1975 and was approved by ECNEC on 18-3-1976 with the condition, that attempt should be made to set up this unit under private sector. As no response was received from private sector, later on, it was decided to set up this unit in Public Sector on joint collaboration with private sector/foreign investors. The approved estimated costs of this project was Tk.347.73 lakhs including Tk.107.89 lakhs in foreign exchange.

As such, this project was referred to BSRS and BSB. Both of these organisations replied that they did not receive any response from private sector. In the same way it has been referred to the Ministry of Industries to give its responsibility of implementation of this project to Rajshahi Division Development Board.

On the basis of the above decision BSFIC proposed to finance this project out of FRG Project Loan and the Planning Commission was approached accordingly. Ultimately the FRG expressed their inability to finance this project.

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LOCATION AND SITE

Land Survey:

The decision about the location of the site was submitted after a comprehensive investigation. Some aspects concerning the location has shown the advantage to set up the production unit close to the material base and shorten the supply ways as much as possible. On the other hand it was taken into consideration that the region Nawabganj, where from the mangoes mainly come, has been very often suffering by floods, that occurs mostly in the monsoon period, that is also the peak season of mango and other fruits. This fact could very seriously hamper the production and threaten the stock of materials and ready products. As there is no existing industry in and around the Nawabganj area, so the proposed factory should have to face the problems of qualified manpower, repairs of machinery equipment etc. After having taken into consideration all this technical and economic circumstances, it is recommended to set up the production unit by the side of the Rajshahi Sugar Mills of BSFIC in Rajshahi. The plant can be supplied with raw material by road or by railway from the station Amnura direct to the factory siding.

The location of the plant in the neighbourhood of the Sugar Mills has doubtless a lot of advantages, which will favourably influence the whole economy, especially :

1. Availability of easy Electric Connection.
2. Sufficient supply of drinking water.
3. Availability of trained staff in managerial and technical sphere.
4. Quality control laboratory.
5. Corporate transport means including railway siding.
6. Possibility of utilizing bagasse as fuel for boilers.
7. Easy supply of sugar from the Rajshahi Sugar Mills.
8. Corporate waste water disposal plant.
9. Corporate contract system for sugar cane, fruits and vegetables etc.

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10. The surrounding of Rajshahi is important producer of vegetables.

There are also public facilities like hospital, schools, library, cinema etc. and good connection by road and railway.

LOCATION:

The processing unit will be erected on the site of the Sugar Mills, that belongs to the BSFIC. The annexed site plan shows the most probable location of the processing unit behind the sugar factory in Rajshahi. The measurements of the site plan seem not to be quite correct and should be checked again.

Acreage demands:

For the erection of the plant following acreage of land will be needed :

1. Sorting room and stock of fresh fruit	474 m ²
2. Production hall	685 m ²
3. Cold Store	320 m ²
4. Store of material and ready products	1,605 m ²
5. Auxiliary Buildings	150 m ²
6. Dressing room, toilets, lavatories	250 m ²
7. Waste water treatment	Corporate
8. Yards	2,500
9. Roads	1,600
TOTAL :	.....

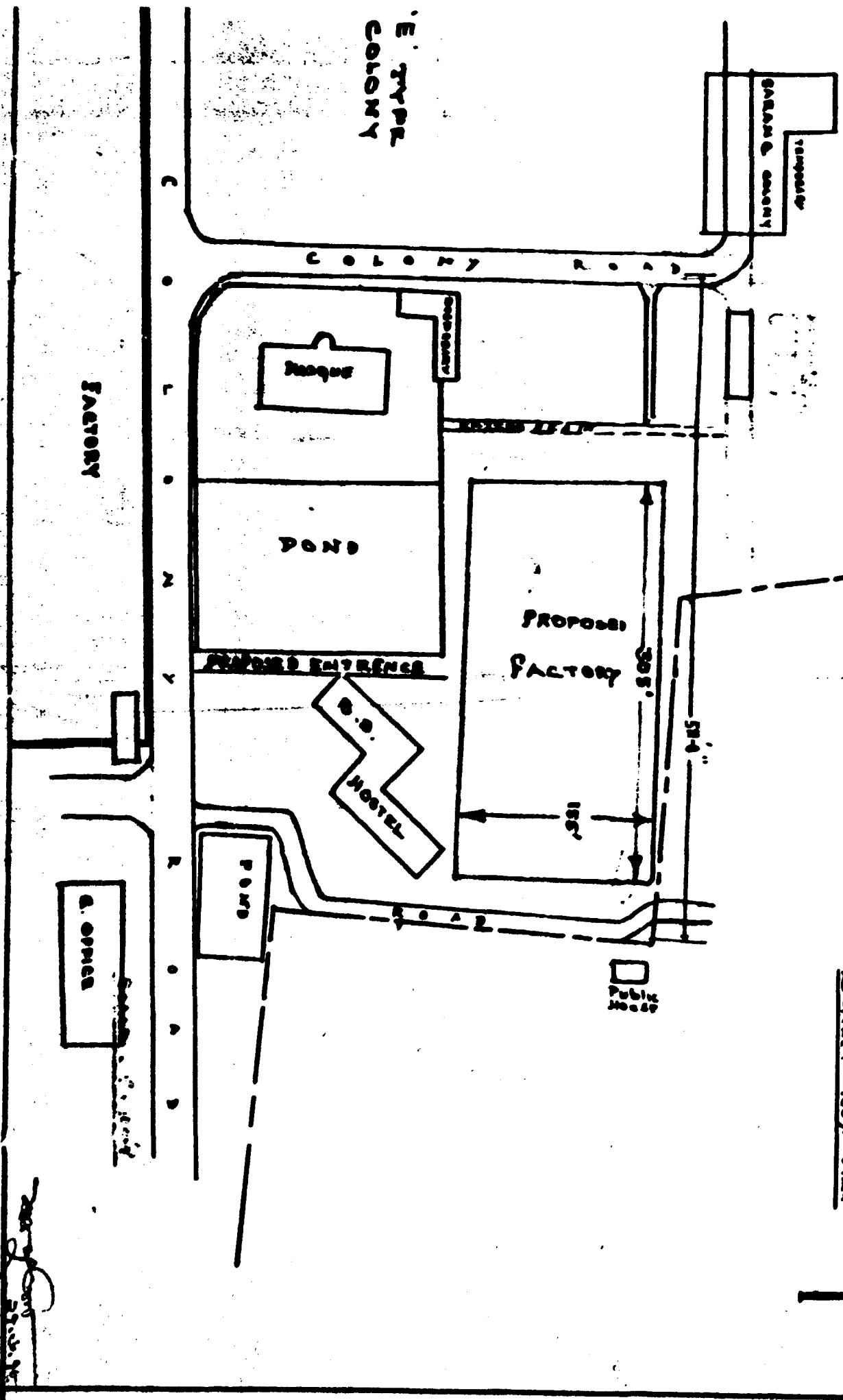
	<u>7,584 m²</u>

The land is already in possession of BSFIC, therefore no extra expenditures for the buying of land will be necessary.

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**A SITE PLAN SHOWING THE LOCATION
OF PROPOSED FRUIT PROCESSING
INDUSTRIES AT R3SM.**

SCALE: 100 ft. = 1 in.



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Analysis of material resources:

Agronomical and Statistical Data

Mango Fruit: (MANGIFERA INDICA)

Mangoes are well adapted and good growing on BARIND tract soil in the Rajshahi region.

Average production of mangoes is estimated from two to five tons per acre.

A survey about the acreage, number of trees and total production gives :

TABLE NO. 1

<u>Sub-Division</u>	<u>Area in acres</u>	<u>No.of tree.</u>	<u>Tons/ Acre</u>	<u>Total production in Long tons.</u>
Sardah	4,000	1,36,960	3.70	12,400
Chapai Nawabganj	12,795	4,20,850	2.96	37,873
Naogaon	2,685	93,700	3.11	8,350
Natore	1,555	55,900	2.75	4,276

Source : Agricultural Statistic Office, Rajshahi, June 1978.

Yield assessment:

TABLE NO. 2

A survey report about the total acreage and production in tons of the whole region of Rajshahi within the period 1971-1977 is given below :

<u>Year</u>	<u>1971-72</u>	<u>1972-73</u>	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>	<u>1976-77</u>
Acreage	23,905	23,905	24,120	24,150	24,530	24,085
Production	106,375	100,330	73,670	76,050	70,701	62,818

Source : A study report on Fruits and Vegetables processing and preservation in Bangladesh, BSFIC, Dacca 1977.

The harvest time of mango starts in the middle of May and continue till to the end of August.

Litchi:

Litchi is a native of China. The jelly - like eril covering the seed is transluscent, white and has agreeable sweet-acid flavour. The Dinajpur and Rajshahi varieties are most appreciated.

The survey about acreage, number of trees and production are given below :

TABLE NO. 3

<u>Sub-Division</u>	<u>Area in Acres</u>	<u>Tons/Acre</u>	<u>Total production in L.tons 1976-77</u>
1. Sardah	291.50	3.35	977
2. Chapai Nawabganj	147.50	3.39	498
3. Naogaon	172.00	3.39	583
4. Natore	89.00	3.37	300

Source : Agricultural Statistic Office, Rajshahi, June 1978.

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Litchi fruits are supposed to be processed into the canned Litchi pulp destoned.

The harvest season is in May and June.

The survey about acreage, yield and production is given below :-

TABLE NO. 4

Year 197, - 77

<u>Sub-Division</u>	<u>Area in Acres</u>	<u>Tons/Acres</u>	<u>Production in long tons</u>
1. Sardah	430	2.96	1,273
2. Chapai Nawabganj	350	2.91	1,018
3. Naogaon	345	2.91	1,003
4. Natore	200	3.08	616

Source : Agricultural Statistic Office, Rajshahi, June 1978.

Tomato will be processed into tomato juice, tomato puree and ketchup.

The harvest season of tomato is December to the beginning of April. By introducing modern varieties (San Marzano) and other types of tomatoes, it would likely be possible to produce tomatoes even in summer and monsoon.

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Cucumbers:

For industrial processing mostly small sizes of cucumbers, size 5-7 cm (1st class), 7-9 cm (2nd class), 9-12 cm (3rd class) will be needed. From long size cucumbers so called canned cucumber slices sterilized (peeled or unpeeled) can be processed. But the quality of this product is beyond the former named small size varieties.

A survey report about the acreage, yield and production is given below :

TABLE NO.5

<u>Sub-Division</u>	<u>Area in Acres</u>	<u>Tons/Acres</u>	<u>Production in tons</u>
1. Sardah	114	2.37	270
2. Chapai Nawabganj	155	2.23	346
3. Naogaon	72	2.48	179
4. Natore	59	2.37	140

Source : Agricultural Statistic Office, Rajshahi, June 1978.

The harvest period of cucumbers is from the beginning of June to August.

Papaya:

Papaya is planted on 615 acres with the yield of 1,604 tons per year (1976-77).

Source : A Study Report on Fruit and Vegetables processing in Bangladesh - December, 1977 - Planning Division, BSFIC, Dacca.

Harvest period is throughout the year. Peak period : February/April.

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Banana:

In the region of Rajshah banana is planted on 4,450 acres of land with an annual yield of 30,075 tons.

Source : A Study Report on Fruits and Vegetables processing
December, 1977 - Planning Division, BSFIC, Dacca.

Harvest period is throughout the year. The peak period is in December-February and in September-October.

Ready Meals:

This projected plant will be furnished with production line enabling to process ready meals if it is found feasible at all.

The advantages of this advice to set up this production technology in this country should be stated here.

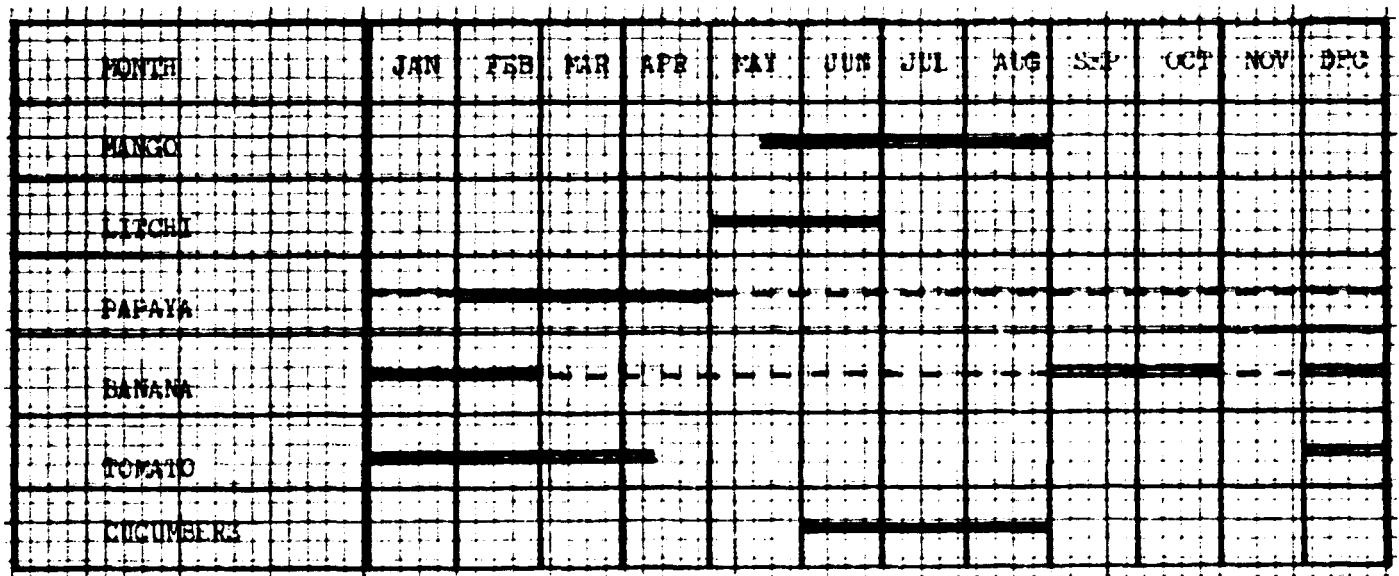
The main reasons are :

1. To build up the necessary supply of canned food to cover the demand of essential ready food in case of natural disasters like floods etc.
2. To supply the military demands with canned food.
3. To supply proper canned food to the developing tourism industry.

The production of new type of ready meal, type "Pilaf" (some thing like our Biriani) consisting of rice with vegetable oil and spice is described in the later part of this study.

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Harvest Diagram of Fruits and Vegetables in the Region of Rajshahi.



Remarks: The full line demarcates peak season.

The stroked line demarcates fruit occurrence within the whole year.

Climatic conditions:

The salient features of the climatic condition of Rajshahi based upon ten years average (1965 to 1974) as obtained from Met Office (on 12-9-78) are given below:-

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT.	NOV.	DEC.
Mean Maximum Temp. in °F	76.66	82.8	91.0	97.96	97.38	92.6	89.31	88.47	89.93	88.13	83.58	78.21
Mean Minimum Temp. in °F	53.41	53.83	64.68	74.17	77.22	78.72	79.0	78.96	78.3	74.05	64.4	54.95
Relative Humidity in % (at 0000 GMT)	91.60	86.7	81.10	82.88	87.77	90.76	94.40	94.0	94.3	91.8	94.0	91.10
Relative Humidity in % (at 0300 GMT)	74.2	62.9	59.55	65.88	71.55	81.66	85.2	85.8	83.2	78.5	75.5	74.9
Relative Humidity in % (at 1200 GMT)	63.20	52.10	44.88	40.70	56.11	75.88	82.9	81.90	79.9	75.3	69.8	67.6
Rain Fall in Inch.	0.50	0.31	1.62	1.35	4.97	17.34	18.74	12.17	9.95	4.10	0.87	0.29
Number of Thunder Storms	.04	0.80	1.90	3.30	7.40	6.80	3.40	3.70	5.40	2.60	.02	0
Wind speed in Knots(0000GMT)	0.52	0.41	0.82	1.70	1.67	1.64	1.99	1.63	1.44	0.97	0.67	0.69
Wind speed in Knots(0300GMT)	1.68	1.35	1.91	2.80	2.83	2.63	2.59	2.44	2.37	2.25	1.81	1.94
Wind speed in Knots(1200GMT)	0.50	0.73	1.28	1.88	2.95	2.61	2.15	2.35	1.52	1.34	0.60	0.51

Remarks : Occurance of squall, hail storm and dust storm were almost nil.

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Planned progress in the Agronomical spheres:

Mango:

When considering the Table No.2 it is to be noted that the development of the yield of fruits in comparison with the increased acreage shows unsatisfactory results. The crop of the fruit in the year 1976-77 shows approximately 62% yield of the production achieved in 1971-72. In this connection the statement of Sharp-Gravens Research Inc. in "Study of Perishable Food Marketing" (July, 1969) should be mentioned, where it was stated that orchards on the barind soils in the region Rajshahi are 50 or more years of age and they are beginning to decline in production because of senescence and attack by wood borers. Except wood borers I found within my stay in this region another insect attacking flowers and young leaves called Mango Shot (*Apsylla Cistellata*, family Psyllidae). The Horticultural Base Kashia Danga in Rajshahi Court and Agricultural Research Sub-Station, Kazla, Rajshahi have already started their work to improve the planting of selected varieties of mango. The first named organisation produces around 10,000 young mango trees. Another base, as it was told by the manager of the base, produces another 100,000 trees of mango. In spite of this the demand is higher than the present production of saplings.

To overthrow the mango shot by chemical sprays is the main task of the present time to stop the permanent declination in the production of the fruits. According to the local farmers the production of mangoes in attacked orchards was 30% less in the last season.

Propagation of saplings including organisation of nurseries will be necessary.

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Cucumbers and other vegetables:

The quality of the soil and climatic condition gives the reasonable presupposition to spread out this production, hence there will be demand to process standard high quality of cucumbers and other vegetables.

Generally higher attention should be given to the introduction of improved cultural techniques and practices not only of vegetables, but also of mango fruit production.

For planting of proper varieties of cucumbers special seeds of small size cucumbers should be imported first.

From the very start of this production sliced cucumbers (from large local cucumbers) is projected.

Laboratory Tests:

In order to get some closer knowledge about the measures, weight of peel, core, the yield of flesh, analytical values, the Division of Food Technology and Nutrition BCSIR Laboratories, Dacca was asked to work out total evaluation of mango fruits.

10 (Ten) numbers of fruit were supplied and results thus obtained are given in the Table No. 6.

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Technological feasibility of the Fruit:

Mango (Magnifera Indica)

Hundreds of varieties of mangoes are known in the world. It varies considerable in size, shape, colour and flower. The shape varies from round to oval-oblong with the length varying from 2 to 30 cm in different varieties and the weight from several grams to more than a kilogram.

Indicies of maturity:

Numerous attempts have been made to establish the point at which time to harvest mangoes for processing or shipment. Different stages of maturity are based on changes in colour, shape and size. The best stage seems to occur, when the shoulders have out grown from the stem end. For keeping fresh fruit on stock, the temperature of $+7^{\circ}\text{C}$ is recommended.
(A. C. Hulme)

The analytical values mentioned in Table No. 6 should be completed with data about chemical composition of ripening fruits. Mango is particularly a rich source of vitamin C. The content of ascorbic acid varies according to the maturity of fruit.

During the early stage of growth the fruit contains strikingly large amount 300 mg of ascorbic acid/100 g fresh fruit. This amount decreases at maturity to 69.5 mg for medium sized and 39.1 mg/100 g fresh weight for large fruit. Beside this some varieties contains Vitamin B1 and Vitamin B2 (riboflavin). The mango is also rich in carotene and other carotenoid pigments.

Varieties : In the region of Sibganj - Nawabganj mostly

planted varieties are :	Fazli	--	60%
	Aswina	--	30%
	Other	--	10%

Among these Aswina is the late variety.

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Litchi

The Rajshahi variety belongs to one of the best that occur in Bangladesh.

The skin will be manually peeled.

Analytical values : Brix 12° - 14.8°

Acidity : 0.2 - 0.36% (citric acid).

Papaya:

Will be processed at 75% maturity (Fruit desert)

Analytical values : Brix 16 - 17.5°

Acidity 0.2% (Citric acid)

Banana:

Will be processed at 75% maturity (Fruit desert)

Analytical values : Brix : 16 - 17°

Acidity : 0.3% (malic acid)

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WATER SUPPLY:

The consumption of water will be 8.3 litres per sec. estimated. Primarily it is calculated, that drinking water will be taken from the Sugar Factory.

It must be separately proved, whether the installed capacity will cover the water demand for both the production units.

Otherwise new wells should be bored.

Quality of water from Rajshahi Sugar Mills:

According to the report collected on 30-6-1978, the analysis of water shows following results :

1. Total hardness of water = 206.00 ppm CaCO₃
= 11.53° German Degree.
2. pH at 20°C temp = 7.4

The analysis was done by Dr. M. A. Rouf of BCSIR Laboratories, Dacca.

In any way the quality of water must correspond with WHO prescriptions for drinking water quality, as the products are supposed to be exported also.

The quality standard for drinking water is given in the annexure No. 1

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Technology:

Projected production capacity:

The production capacity of the projected production unit that is mentioned in the PP, is rather low and it would be very difficult to equip this unit with relevant machinery equipment, as now-a-days processing machines with much higher capacity have been built.

With regard to the occurrence of the fruits and vegetables two production lines are projected with concentration unit to concentrate tomato juice in puree and mango juice into mango concentrate.

The harvest time of fruit, tomatoes and vegetable enables to make use the line No. 1 nearly all the year.

Line No. 1:

Capacity projected: 1,500 kg juice per hour
(tomato or mango juice) or,
Concentrated mango juice or tomato puree 355kg per hour
or tomato ketchup, capacity 355kg per hour

Line No. 2:

Capacity projected: 1,500 kg canned fruit in syrup per hour

It is combined line, where there will be processed:

- 1) Litchi pulp in syrup sterilized
- 2) Fruit desert in syrup sterilized
- 3) Mango pulp(slices) in syrup sterilized
- 4) Cucumbers in sour sweet brine sterilised 1 ton/hour
- 5) Ready meal 0,5 ton/hour

1st alternative:

According to the course of the harvest season, the line No. 2 will run in 3 shifts, as some fruits and vegetables occur synchronous.

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2nd alternative:

A 3rd line may be installed, very similar to the Line No.2.
The production will be divided into "sweet" and "sour"
production.

In the initial stage th lines No.1 and No.2 are projected only.

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Working time:

For further working schedule and production capacity planning,
following working time is projected :

1 shift = 8 hours working time = 480 minutes
less $\frac{1}{2}$ hour for making up of the work place,
cleaning and greasing of machines, personal
relief.

1 week = 48 working hours
Nett production time 45 hours.

1 month = differs, see time table.

TIME TABLE(1978):

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DAYS	31	28	31	30	31	30	31	31	30	31	30	31
HOLIDAYS	5	6	4	6	6	4	6	4	8	7	7	8
NETT WORKING SHIFTS	26	22	27	24	25	26	25	27	22	24	23	23
WORKING HOURS	208	176	216	192	200	208	200	216	176	192	184	184
NETT PRO- DUCTION TIME-HOURS	195	165	202	180	187.5	195	187.5	202	165	180	172.5	172.5

...../

TABLE - 6

DIVISION OF FOOD TECHNOLOGY & NUTRITION
BCSIR LABORATORIES, DACCA.

R E P O R T

No. of Samples : 10

Ref. No. PP/73.02/B/1648 dt. 5-7-78.

Date of Receipt: 5-7-78

Received from/Referred : Bangladesh

Date of submission

Sugar & Food Industries Corporation,

of report : 13-7-78.

Dacca.

Particulars of Sample: Mango

Result:

Sl. No.	Initial weight of each mango in (gm)	Wt. of skin of each mango in (gm)	Wt. of stone of each mango (gm)	Wt. of pulp of each mango (gm)	pH	Citric Acid %	Soluble solid %	Total solid %
1.	570.0	74.0	46.5	449.5	3.60	1.14	11.50	15.29
2.	627.5	64.5	50.0	513.0	4.37	0.65	14.90	15.87
3.	714.5	71.5	67.5	575.5	4.28	0.48	17.00	17.61
4.	503.0	65.5	42.5	395.0	3.72	0.55	12.35	14.49
5.	590.0	66.5	61.0	462.5	4.40	0.57	16.10	17.30
6.	583.0	67.5	61.5	454.0	4.08	0.66	15.24	17.04
7.	663.0	93.0	59.5	510.5	4.07	0.60	12.77	14.01
8.	553.0	79.0	46.0	428.0	3.93	0.73	13.77	16.15
9.	579.0	73.5	49.0	456.5	4.00	0.38	14.84	15.87
10.	645.0	84.0	43.5	517.5	4.19	0.55	13.32	14.79

Remark/Comment

Sd/- Illegible

Counter signed by:

Sd/- Illegible
13-7-78

Signature of the Analyst.

Production schedule:

According to the projected technology and machinery equipment the plant will produce :

Ready product	Production days	Production capacity per hour Tons	TONS				Production
			1st shift	2nd shift	3rd shift	1 week 7 days	
Mango juice Bx 65° (Concentrated)	105	0.355	2.66	-	-	18.64	279
Tomato juice Bx 29° (puree)	55	0.355	2.66	-	-	18.64	146
Tomato ketchup Bx 38°	50	0.355	2.66	-	-	18.64	133
Mango pulp in Syrup	90	1.5	11.25	-	-	78.75	1,012
Litchi pulp in syrup	60	1.5	-	11.25	-	78.75	675
Fruit desert in syrup	30	1.5	-	-	11.25	78.75	337
Cucumber(slices) in brine	75	1.0	-	7.5	-	52.5	562
Ready meals	90	0.5	3.75	-	-	26.25	337
Projected production in tons							3,481

...../

Time schedule of ready products being projected:

Mango juice concentrated	15 May - 30 August	1st shift	105 days
Tomato juice concentrated	1 Dec - 25 Jan.	1st shift	55 days
Tomato Ketchup	26 Jan - 30 March	1st shift	50 days
Mango pulp in slices	15 May - 30 August	1st shift	105 days
Litchi Pulp	1 May - 30 June	2nd shift	60 days
Fruit Desert	15 May - 15 June	3rd shift	30 days
Cucumber in sour sweet brine	16 June - 30 August	2nd shift	75 days
Ready meals	1 Sept - 30 November	1st Shift	90 days

Harvesting periods according to : "A Study Report on Fruits and Vegetables Dec.1977 BSFIC,Dacca."

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Production pararellity:

Product	Line No.	Capacity in Tons	
Mango juice concentrated	1	0.355 t/hour	1 shift 2.66
Mango pulp in syrup	2	1.5 t/hour	1 shift 11.25
		1.855 t/hour	1 shift 13.91

The composition of single production lines has been designed to be highly versatile.

Line No.1: Can run for the production of natural mango juice or tomato juice, or concentrated mango juice and production of tomato puree or ketchup.

The Line No. 2:

This line will process all canned fruit in syrup sterilized, cucumbers pickles sterilized and during the dead fruit and vegetable season, it can be used to process sterilized ready meal. This line is also highly versatile.

To approach closer to the projected technology and project at all following :

1. Production schemes
2. Production standards
3. Quality standards
4. Man-power demand and
5. List of machinery equipment

have been proposed.

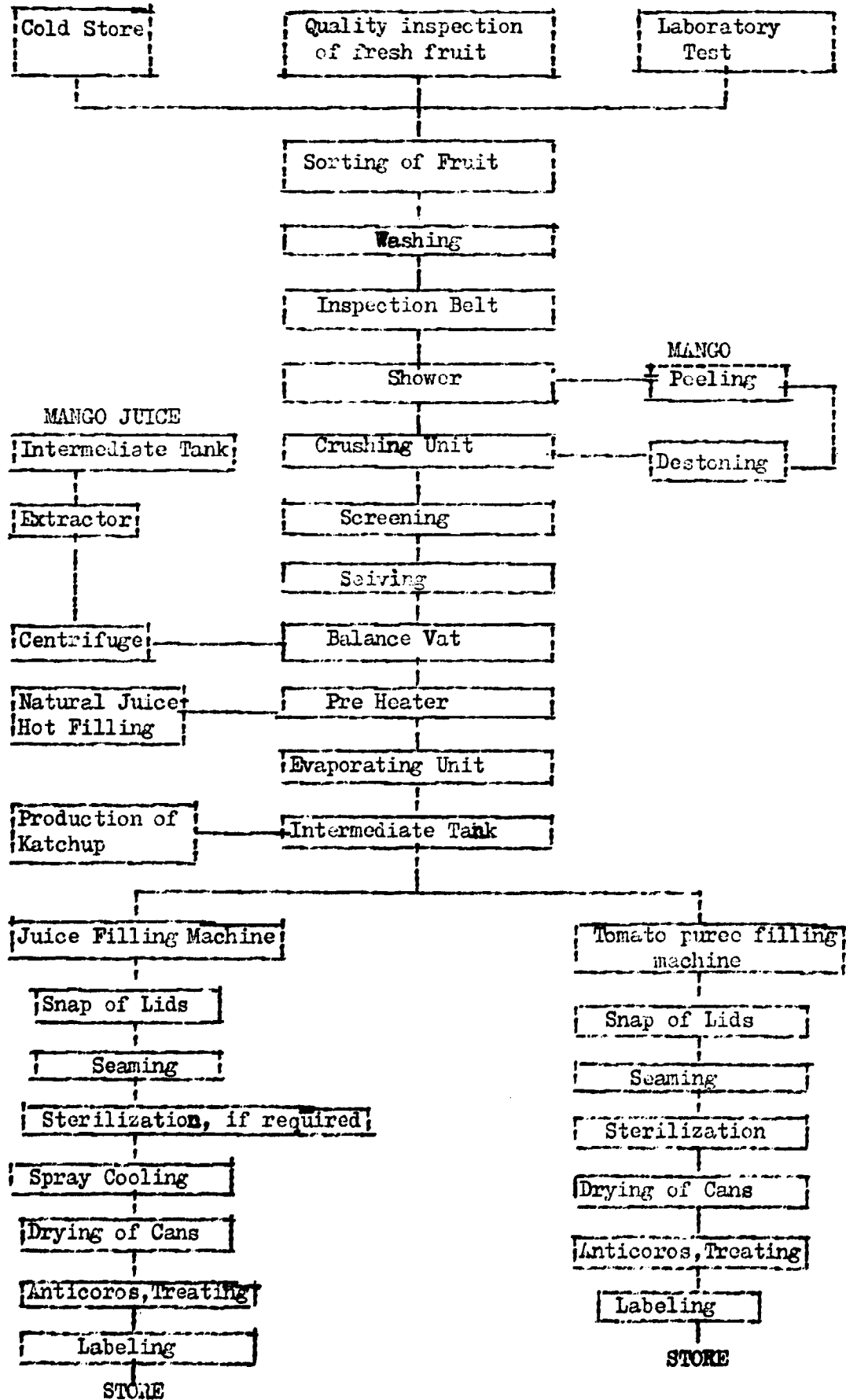
1. PRODUCTION SCHEMES NO. 1 - 7

2. SUPPLEMENTARY PRODUCTION SCHEMES NO. 8-12

PRODUCTION SCHEME NO.1:

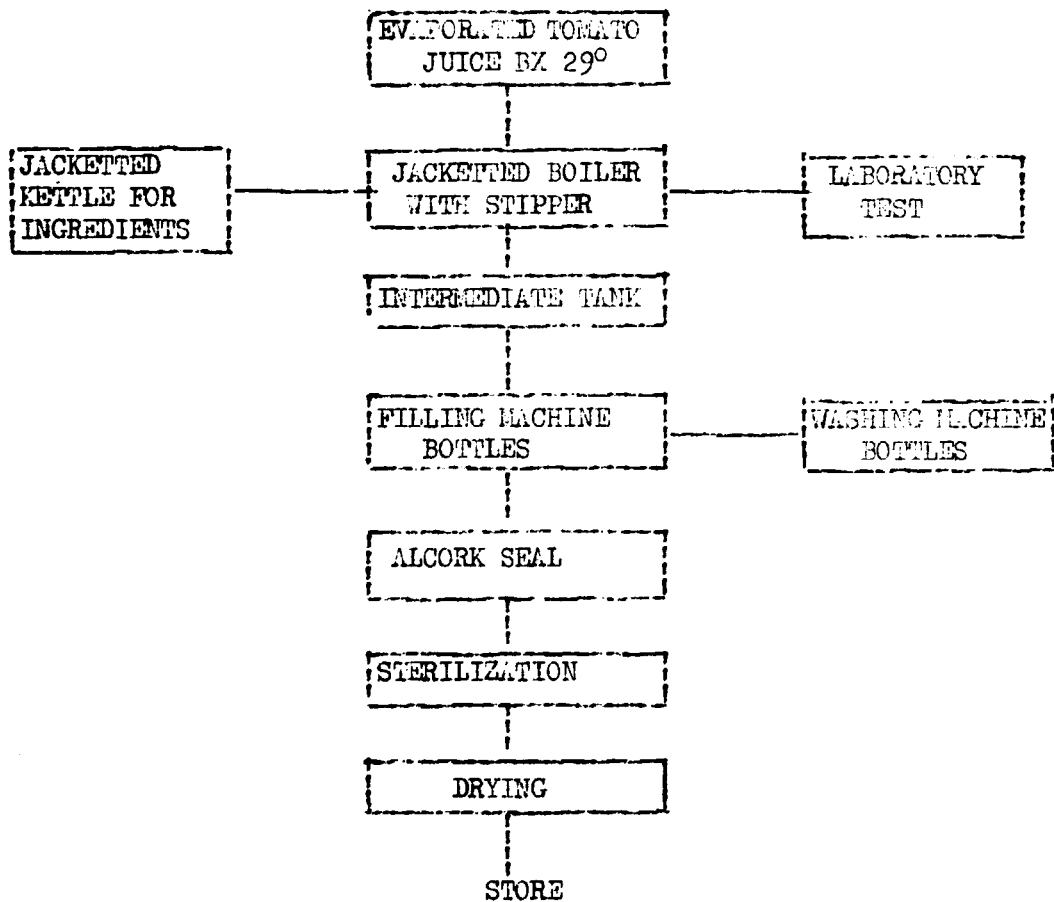
TOMATO JUICE : Natural
Concentrated

MANGO JUICE : Natural
Concentrated



PRODUCTION SCHEME NO.2:

TOMATO KATCHUP IN BOTTLES - CONTENT 0.33 L BOTTLES/HOUR

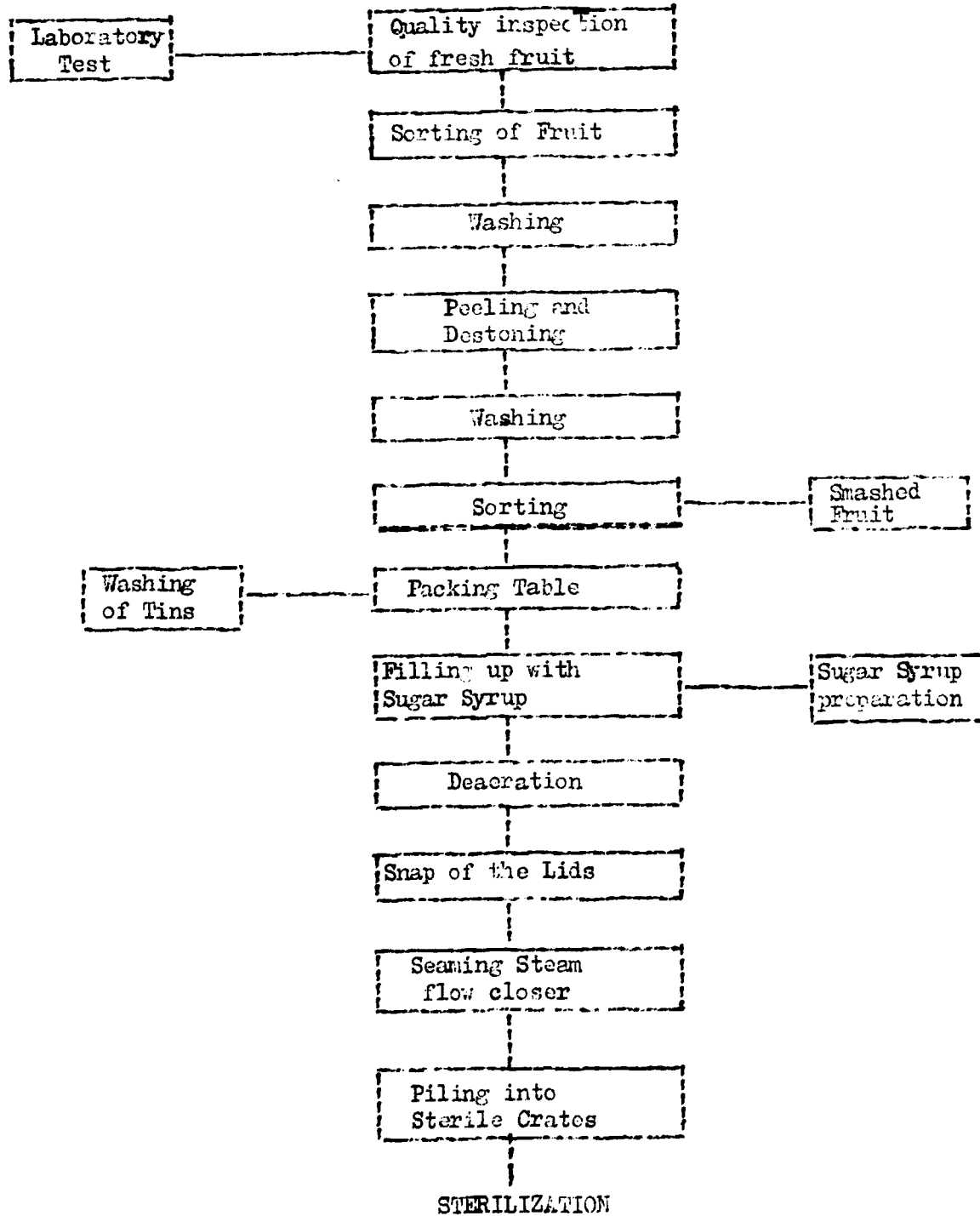


PRODUCTION SCHEME NO.3:

Litchi pulp in syrup sterilized

Production capacity : 1,764 numbers tins 99 x 118 /hour

1 piece = 2 sec.



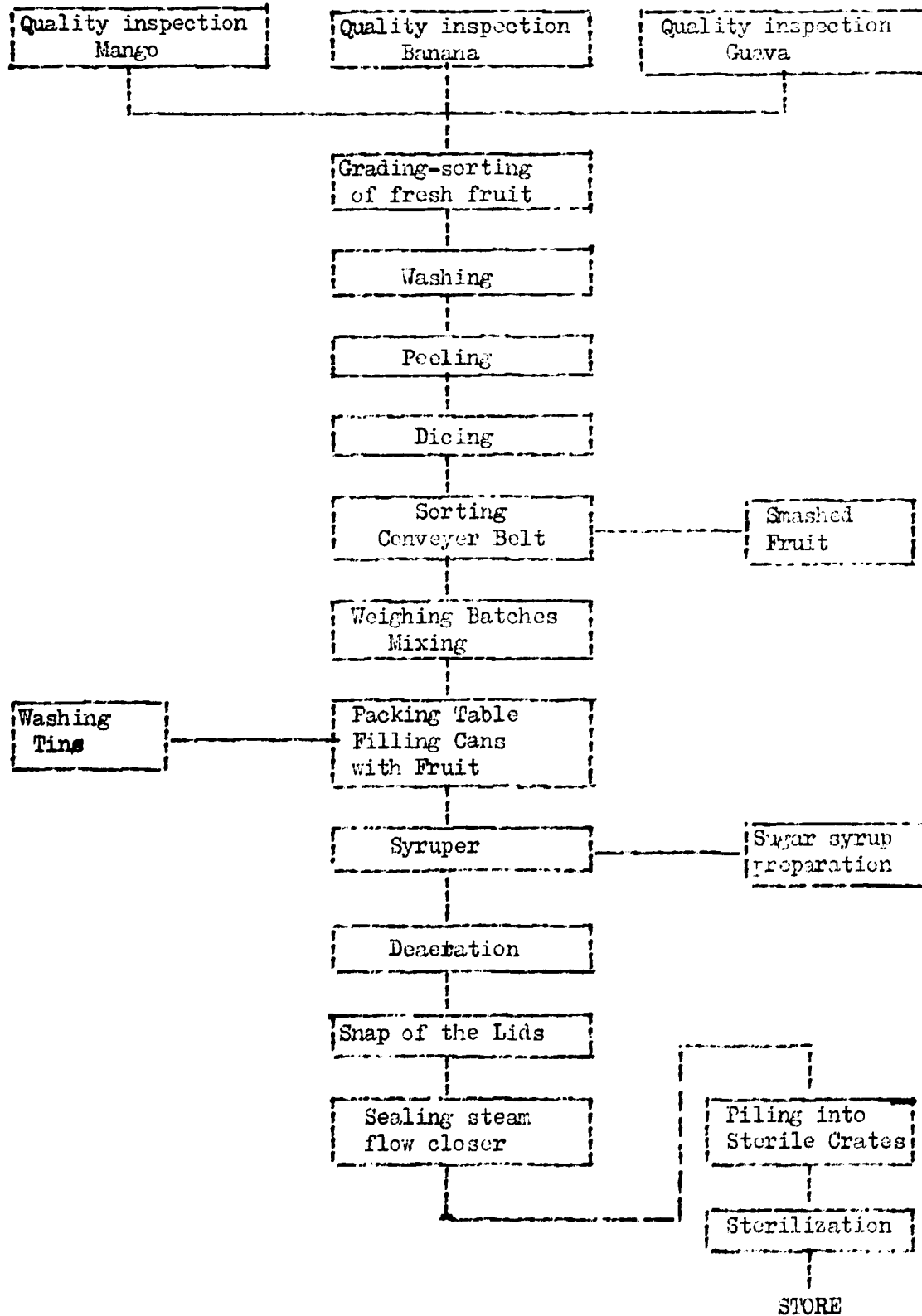
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PRODUCTION SCHEME NO. 4:

Fruit Desert in Syrup sterilized

Production capacity : 1,764 tins 99 x 118 mm/hour

1 tin = 2 sec.

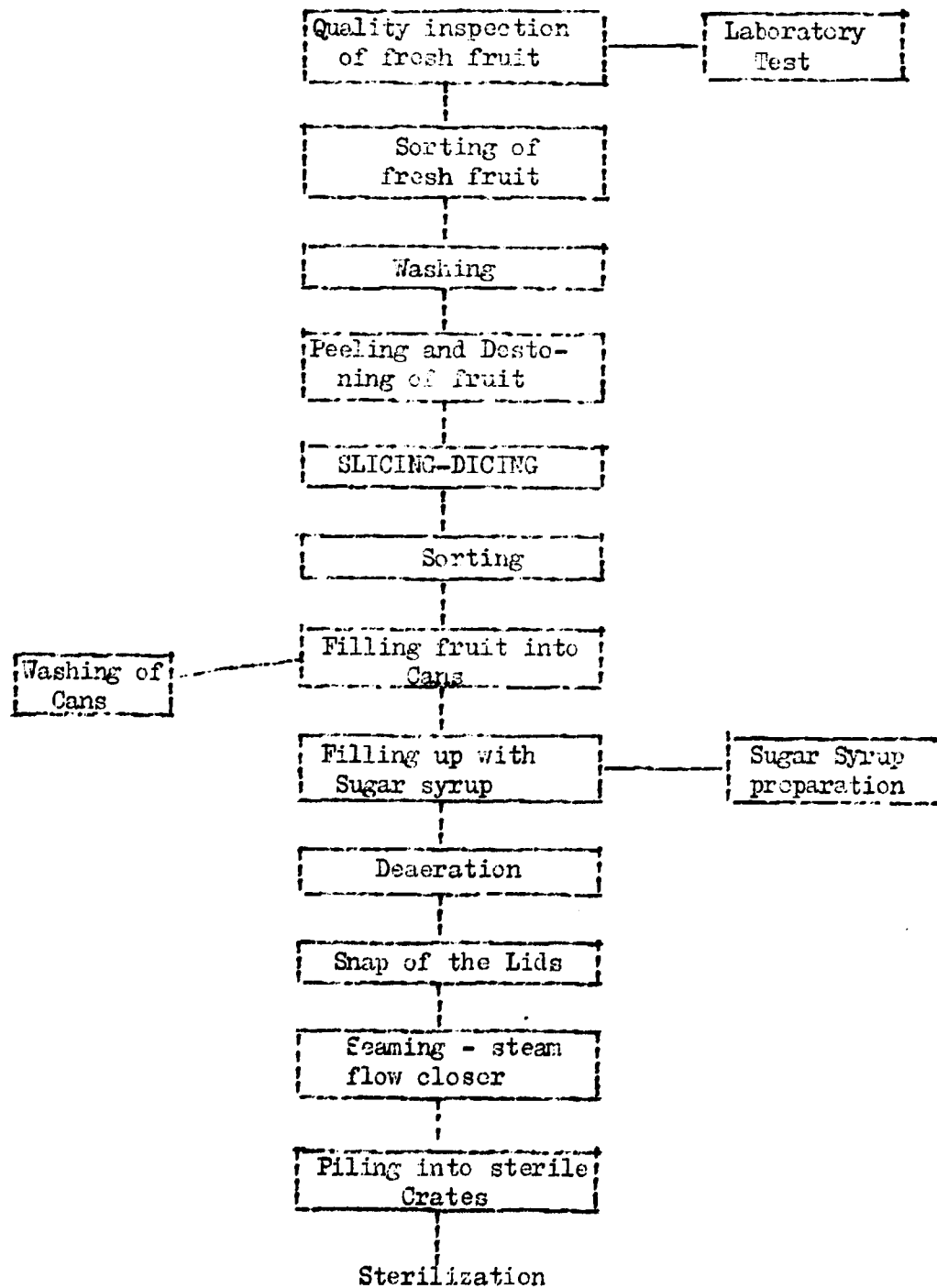


PRODUCTION SCHEME NO.5:

Mango pulp (slices) in syrup sterilized

Production capacity : 1,764 numbers tins 99 x 118 / hour

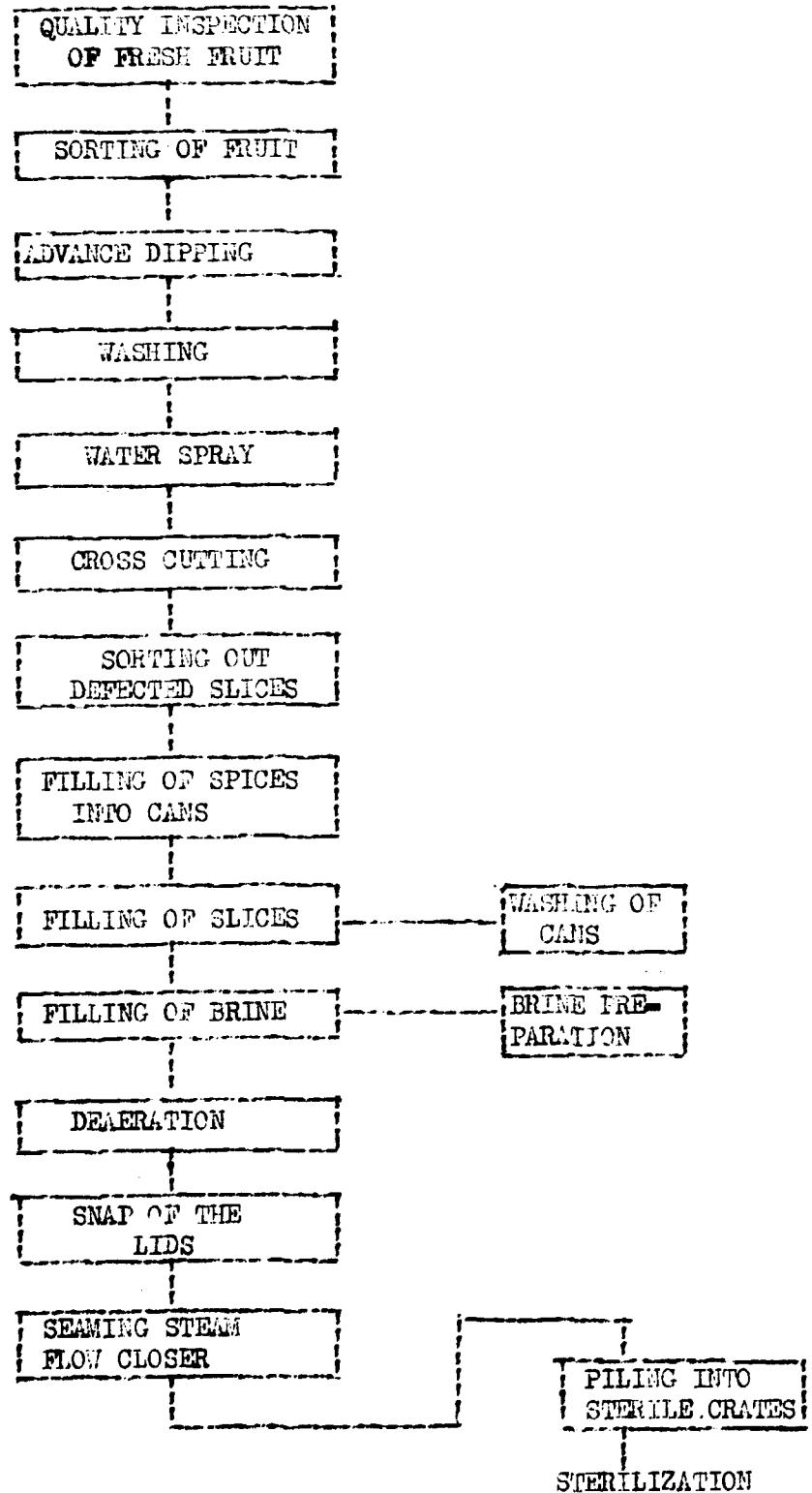
1 piece = 2 sec.



PRODUCTION SCHEME NO.6:

SLICED CUCUMBERS IN SOUR-SWEET BRINE:

Production capacity : 1,764 numbers tins 99 x 118 mm/hour
1 piece = 2 sec.

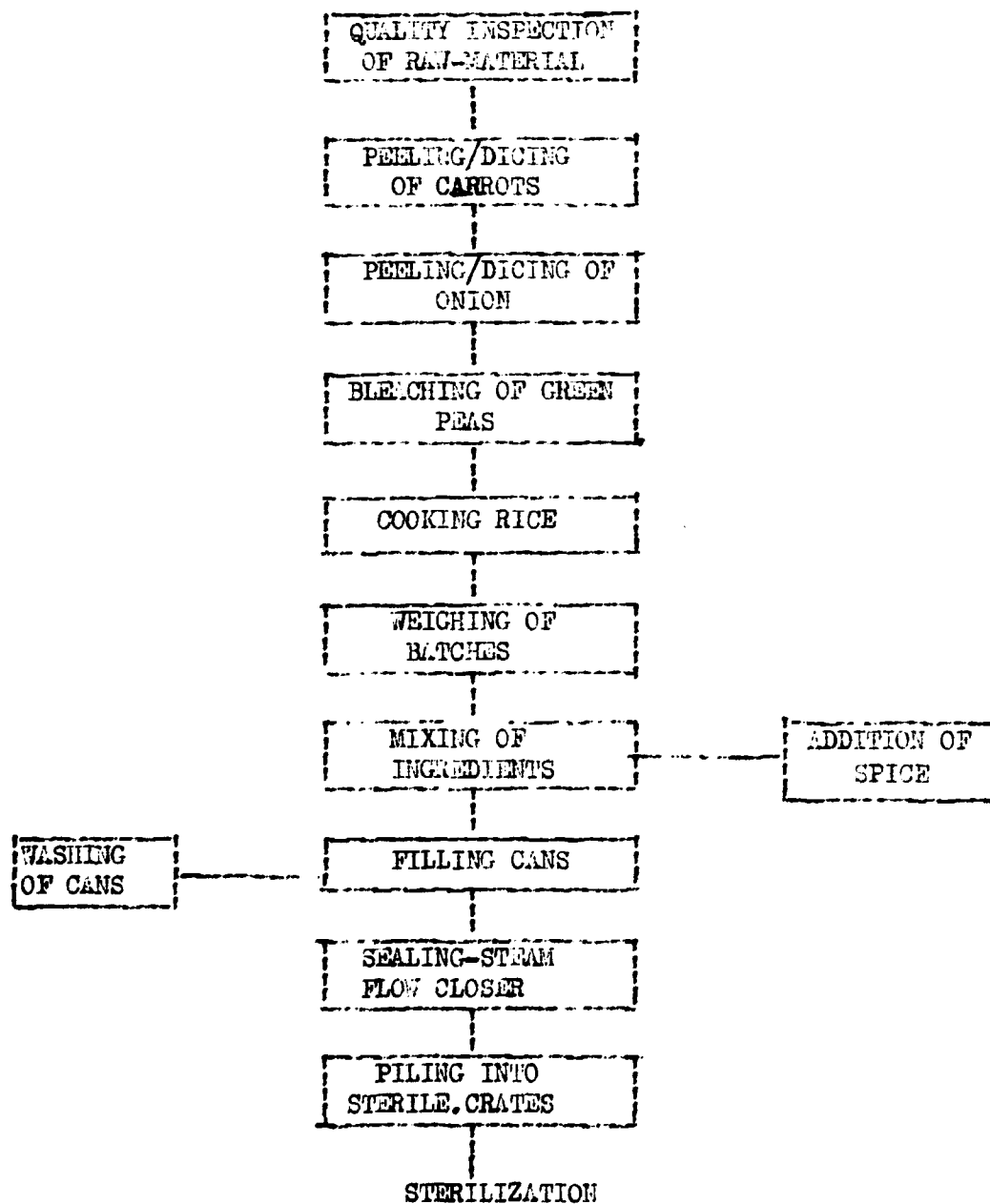


PRODUCTION SCHEME NO.7:

READY MEAL "PILAF"

Prepared from cooked rice, vegetable, vegetable oil and spice.

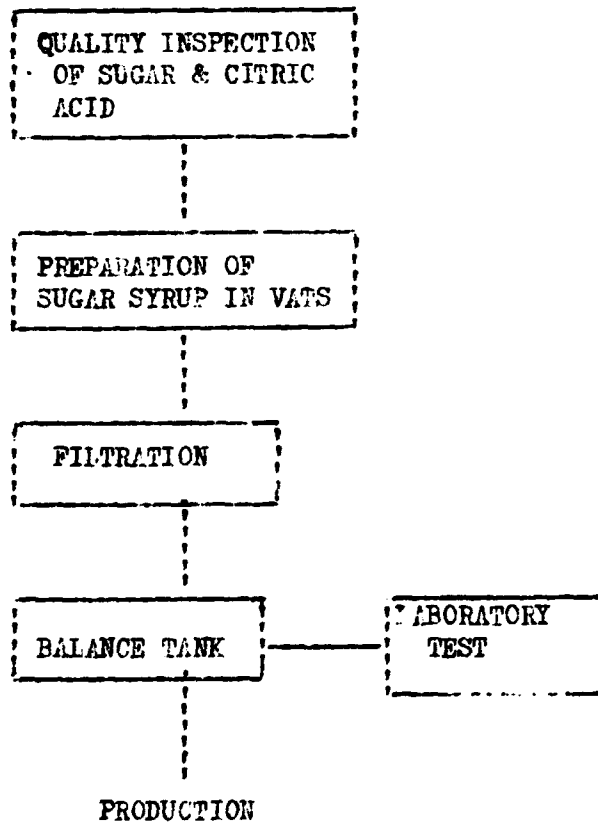
Production capacity : 0.5 tons/hour in tins 99 x 118,
nett weight 850 g



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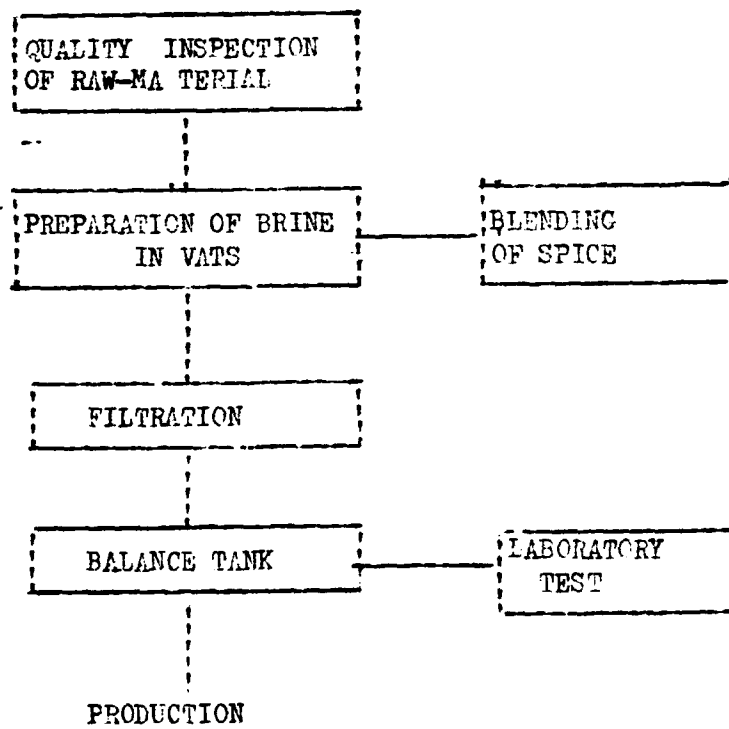
SUPPLEMENTARY PRODUCTION SCHEME NO.8:

SUGAR SYRUP PREPARATION:



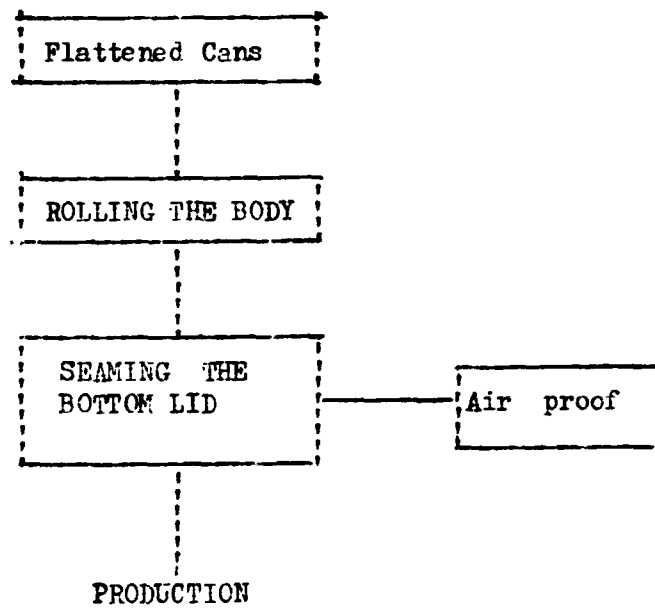
SUPPLEMENTARY PRODUCTION SCHEME NO.9:

SOUR-SWEET BRINE PREPARATION:



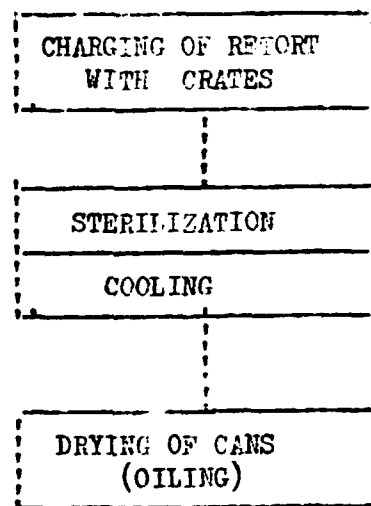
SUPPLEMENTARY PRODUCTION SCHEME NO.10:

RECONDITIONING EQUIPMENT FOR FLATTENED EMPTY CANS:



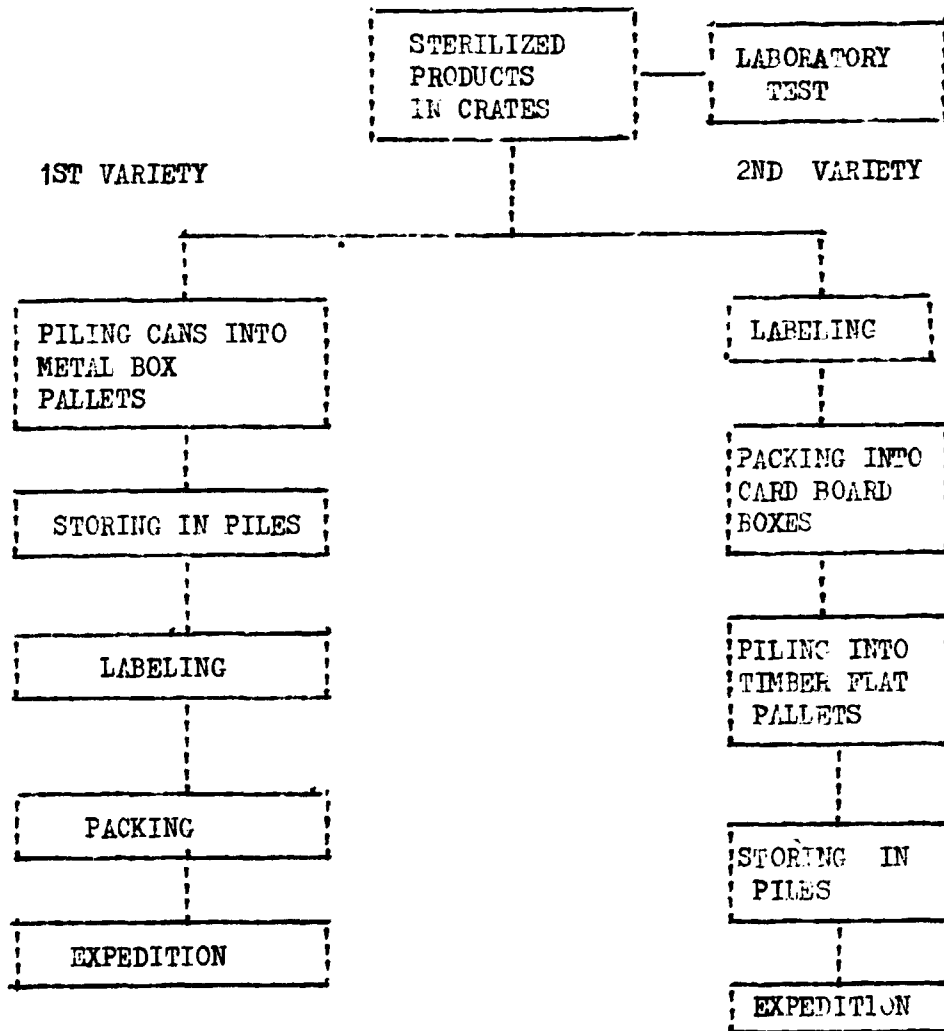
SUPPLEMENTARY PRODUCTION SCHEME NO.11:

STERILIZATION:



SUPPLEMENTARY SCHEME NO.12:

STORAGE OF READY PRODUCTS:



CLAIMS FOR QUALITY:

a) FRUITS:

1. FRESH MANGO:

The fruit must be fresh, sound, not over-ripened, clean, the skin without sores of pressing or knocking.

The minimum weight of the fruit : 550 gm.

The colour of the skin : Green - yellow-green.

Analytical value : min. Brix. 15.0°

Flesh : Compact, firm, but without tough fibres, slightly yellow till orange yellow.

2nd quality:

The demands on the quality are the same, only the weight of the fruit is less than 550 g but than 450 g . not lesser than 450 gm.

3rd quality:

Quality demands the same. The fruit may be ripe, but still in good condition. This quality will be mostly used for the production of juice.

Packing of mango fruit:

The fruit will be transported in special crates made of cratewood, capacity 15 kg of fresh fruit each. The crates must be clean, dry and compact.

The dimensions of the crates will be uniform and the dimensions must be modulus with the timber pallet 80 x 120 cm. The pallet will hold 4 crates in 1 shift.

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2. Fresh Banana:

Quality demands:

For the production of fruit desert only one quality will be acknowledged.

Size : Length minimum 16 cm, diameter of the fruit :
4 cm in the middle part.

Colour: Typical yellow green banana, without sores of pressing or knocking.

The flesh: firm, compact, slight yellow-cream colour, seedless, without black spots.

The skin must be easy to peel.

Packing of banana:

The banana will be transported and stored in timber crates each 15 kg nett only. The size of crates will be the same as with mango (and other fruits).

3. Papaya:

Quality demands:

For the production of the fruit desert only one quality will be acknowledged.

Size : length min. 15 cm, dia 9 cm.

The skin : Green to yellowish green without damages due to the knocking, sound, clean and dry.

Flesh : firm, compact, without damages, sound dry.

The colour of the flesh : yellow till orange-yellow. The total content of sugars minimum 16° Brix.

Packing of Papaya:

The Papaya fruit will be transported and stored in timber crates only, each 20 kg nett.

..../

4. Litchi:

The fruits must be separated from clusters, cleaned from the warty rind without damages & dried.

The size : diameter 40 mm.

Total content of sugars : 14^o Brix.

Packing : In wooden crates, each 15 kg nett.

5. Cucumbers:

The fruit can be of maximum 4 cm diameter and should be fresh. The skin must be green, sound and without damages. The flesh must be free from pressings. The seedy part must be compact and tough.

Packing of cucumbers: In wooden crates, each 15 kg nett.

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Ingredients:

Sugar type : crystalline sugar, refined.

Size of crystals : middle size, export quality.

Colour : White solely, brown shade not allowed.

Impurities : None (Nil).

Smell : Nil - molasses smell not allowed.

Humidity : max. 0.1%

Packing : Jute bags.

Weight : 50 kg or 100 kg bags.

Citric Acid:

Size of crystals : Middle size, regular type.

Quality : Food processing proved.

Colour : White, impurities are not allowed.

Smell : Nil.

Humidity : Maximum 2%

Packing : Plywood drums 20 kg nett, or polythene bags.

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Packing material:

Cans : Made from tin-coated or tin-plated fine steel plates, preferably with lacquered shift inside.

The quality of tin-coated and tin-plated sheets is expressed in the quantity of tin in grams used for 1 m^2 of the plate. The perfect quality of tin-coated sheet is about 7 g/m^2 , with tin plated sheet $5-6 \text{ g/m}^2$.

In any way the tin coatings must protect the content of the can for at least 12 months shelf life against corrosion affects or change in colour of the canned fruit/juice. For canning of concentrated juice lacquered tins are recommended (high content of acids).

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PACKING MATERIAL FOR SINGLE PRODUCT:

The projected production is supposed to be packed into following packing material :

1. Mango juice concentrated Brix 65°
Cans size 72.8 x 115.00 mm
(alternatively mango juice natural Brix 16°)
2. Tomato juice concentrated Brix 29°
Cans size 72.8 x 115.00 mm
(alternatively tomato juice natural Brix 5°)
3. Tomato ketchup Brix 38°
Bottles, content 10 cc = 283.4 g Ketchup.
4. Mango pulp in syrup sterilized:
Cans size 99 x 118.00 mm
(alternatively 99 x 63.5 mm)
5. Litchi pulp in syrup sterilized:
Cans size 99 x 118.00 mm
(alternatively 99 x 63.5 mm)
6. Fruit desert in syrup sterilized:
Cans size 99 x 118.00 mm.
7. Cucumber slices in sour-sweet brine, sterilized:
Cans size 99 x 118.00 mm
(alternatively 99 x 63.5 mm)
8. Ready meals (Pilaf) sterilized:
Cans size 99 x 118.00 mm

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LIST OF MACHINERY EQUIPMENT

FOR THE PROJECTED PRODUCTION

POWER DEMAND:

In the initial stage of projection no exact types of machines has been selected. Therefore, mean demands on power in this stage is calculated below.

Simultaneous power demand will be :

Product	Quantity	Steam demand tons	Electric power demand KW	Drinking water demand m ³
Concentrated mango juice Brix 65°	1 ton	1.48	12.0	8.0
Ketchup	1 ton	0.60	8.0	7.0
Mango pulp in syrup	1 ton	0.80	15.0	8.0
Power demand:		2.88	35.0	23.0

Remark : The above mentioned production represents the projected maximum of simultaneous demands on steam, electric power and water.

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LIST OF MACHINERY EQUIPMENT

SCHEME NO.1 : Line No.1

Mango juice concentrated and natural:

1. Washing machine with shower, capacity 2000 kg fruit/hour
2. Inspection belt 4m length, speed 0.2 m
3. Shower, capacity 2,000 kg fruit/hour
4. Crushing unit, capacity 1,500 litres/hour
5. Passing machine, capacity 1,500 kilo/hour
6. Sieving machine, capacity 1,500 kilo/hour
7. Balance vat with stirrer, stainless steel capacity . 1,500 litre
8. Pre-heater FMC, heating medium vapour 4.0 At, 151°C
= 658 kcal/kg.
9. Evaporating unit - capacity 1,500 kilo of juice
Evaporating capacity : 1,145 kg water/hour min.
10. Intermediate Tank, identical with pos. No.7
11. Filling machine:
 - a) Natural juice capacity 3,300 cans/hour
 - b) Concentrated juice 65° Brix, capacity 600 cans/h. min.
12. Washing machine of empty cans capacity 1500 pcs/hour.
13. Sealing machine - steam flow closer FMC,
capacity 3300 cans/hour
14. Cooling tunnel with water shower,
capacity 3,300 cans/hour.
15. Drying tunnel, medium : hot air, capacity 3,300 cans/h.
16. Labeling machine, capacity 3,300 cans/hour.

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LIST OF MACHINERY EQUIPMENT:

SCHEME NO.1a : Line No.1

TOMATO JUICE CONCENTRATED AND NATURAL:

The machinery equipment is identical with the Scheme No.1 upto the position No.10.

- No.11. Tomato puree filling machine hot filling,
capacity min. 700 cans/hour
size 728 x 115 mm
12. Seaming machine - steam flow closer FIC,
capacity according to the size of cans:
1) 700/hour 72.8 x 115 mm
2) 4,500/hour 50 x 40 mm
13. Washing machine of tins, capacity according
to the size of cans.

..../

LIST OF MACHINERY EQUIPMENT:

SCHEME NO.2 : Line No.1

TOMATO KATCHUP STERILIZED:

The machinery equipment is identical with the Scheme No.1 upto the position No.10

11. One stage vacuum evaporator from stainless steel, capacity 500 L with stirrer
12. Jacketted kettle capacity 100 L
13. Intermediate tank, stainless steel, heated with stirrer, capacity 500 L
14. Filling machine for jars, capacity 1,000 jars/hour
15. Washing machine of empty jars, capacity 1000 jars/hour
16. Sealing machine, "ALCORK" capacity 1000 jars/h

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LIST OF MACHINERY EQUIPMENT:

SCHEME NO.3 : Line No.2

LITCHI PULP IN SYRUP STERILIZED:

1. Washing machine with shower,
capacity 2,000 kg/hour
2. Inspection belt 4 m length, speed 0.2 m/s
3. Packing table approx. 7 m length with
2 conveyer belts (upper belt will convey empty tins)
4. Washing machine of empty cans
capacity 2,000 cans/hour
5. Syrupe/Filling machine, capacity 2,000 cans
6. Exhaust box with conveyer belt.
7. Sealing machine, capacity 2,000 cans/hour

.... /

LIST OF MACHINERY EQUIPMENT:

SCHEME NO.4: Line No.2

FRUIT DESERT IN SYRUP STERILIZED:

The machinery equipment is identical with the Scheme No.3

The production line will be fulfilled by :

1. Dicing machine, to process cubes 9.5 mm upto 19 mm, capacity 2,000 kg/hour
2. Inspection belt, length 4 m
3. Mixing machine of diced fruit, discontinual operating, capacity 2,000 kilo/hour.

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LIST OF MACHINERY EQUIPMENT

SCHEME NO.5 : Line No.2

MANGO PULP IN SYRUP STERILIZED:

The equipment is identical with Scheme No.3

LIST OF MACHINERY EQUIPMENT:

SCHEME NO.6 : Line No.2

SLICED CUCUMBERS IN SOUR-SWEET BRINE:

The equipment is identical with the Scheme No.3
and will be only completed with

1. Slicing machine (cross cutting machine)
capacity 1,000 kg cucumbers/hour.

LIST OF MACHINERY EQUIPMENT:

PRODUCTION SCHEME NO.7 : Line No.2

READY MEAL FROM RICE, VEGETABLE AND VEGETABLE OIL "PILAF"

Line No.2 will be used for the production of ready meal
(see production scheme No.3) from which used equipment position
will be clear

No.3. Packing table.

No.7. Packing machine

No.1. Dicing machine - see Scheme No.4

Supplementary Equipment:

1. 2 numbers of jackette kettles capacity 200 L each ,
with stirrers.
2. 1 decimal scale, capacity upto 150 kg

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LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO.8:

SUGAR SYRUP PREPARATION:

1. 2 numbers of vats with stirrers, 900 L content each, resisting sour-sweet solutions.
2. 2 numbers balance tanks, 900 L each, from stainless steel, or baked enamel, heat resisting upto 100°C.
3. 1 electric hoist (traweling wheel), carrying capacity 250 kilo min.
4. 1 automatic scale, ponderability upto 150 kg.

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2

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO.9:

SOUR SWEET AND SALTED BRINE PREPARATION:

1. 2 numbers of vats with stirrers, 800 L content each.
2. 2 numbers of balance tanks, 800 L each, from stainless steel, or baked enamel, hest resisting upto 100°C.
3. 1 electric hoist (traweling wheel) carrying capacity 250 kg min.
4. 1 automatic scale, ponderability upto 150 kg.

...../

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO.11:

1. Rolling device - metal box London
2. Seaming machine - Metal Box London
3. Pressure checking device

capacity of the equipment : 4,100 cans/hour.

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LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO.12:

STORAGE OF READY PRODDUCTS:

1. Labeling machine, electric powered,
capacity 3,120 cans/hour,
adjustable for dimensions :

99 x 63.5 mm

99 x 118 mm

72.8 x 115 mm

Glue : Liquid

...../

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO.10:

STERILIZATION FACILITY:

1. 4 numbers of pressure retorts, each of which can hold 2 crates.
2. 1 Electric hoist, carrying capacity 1,000 kg.

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PRODUCTION STANDARDS

No. 1 - 11

1. Quality standards for ready products
2. Consumption standards for the projected production No. 1 - 11

PRODUCTION STANDARD NO.1:

A. Tomato juice:

Analytical values of tomato juice : natural juice
Brix 5.0° pH 3.8 - 4.4

Packing : Tin box 72.8 x 115 mm
Nett weight 16 oz = 453.67 g

Planning unit : 1000 kg juice = 1 ton (metric)
= 2204 tins.

Material consumption per 1 ton of tomato juice :

Fresh tomato, ripe, Brix 5.0° pH 3.8 - 4.4 yield 95%
1,052.0 kg
Tin boxes 72.8 x 115 mm 2,210 nos.
Lids ϕ 72.8 mm 2,213 nos.
Labels 2,210 nos.
Cardboard boxes (24 tins) 92 nos.
Suspensor grids 92 nos.
Labels for the cardboard boxes 92 nos.
Glue strip 92 nos.
Glue 0.6 kg

1 ton of tomato juice 2,204 tins

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PRODUCTION STANDARD NO.2:

E Concentrated Tomato Juice - PUREE:

Analytical values of ready product : Brix 29.0°
pH 3.9 - 4.4
Packing : Tin box 72.8 x 115, nett weight : 510 g

Planning unit : 1000 kg tomato juice - Puree - concentrated
= 1,960 tins.

Material consumption per 1 ton:

Tomato juice Brix 5.0°
Theoretical consumption $\frac{29}{5} = 5.8$ concentration

$$\frac{x}{1000} = 5.8$$

$x = 5.8 \times 1000 = 5,800$ kg tomato juice Brix 5.0°
+ 2.4% loss = 139 kg

Total consumption 5,939 kg tomato juice per 1 ton of
concentrated tomato juice - Puree 29° Brix.

Quantity of water to be evaporated from 1,000 kg (1 ton)
of fresh tomato juice :

$$x = 1,000 \left(1 - \frac{5}{29} \right) = 1000 \times 0.8276 = 827.6 \text{ kg water}$$

Consumption of fresh tomato : 6,248 kg per 1 ton of
concentrate Brix 29.0°

Remark : nett weight derived : 453.67 x 1,122 gms.

...../

Tin boxes 72.8 x 115 mm	....	1,968 Nos.
Lids ϕ 72.8	....	1,970 "
Labels	....	1,968 "
Cardboard boxes (24 tins)	....	82 "
Suspensor grids	....	82 "
Labels for cardboard boxes	....	33 "
Glue strip	....	83 m
Glue	....	0.7 kg

1 ton of concentrated tomato juice - puree 1,960 Tins

2nd variety in packing:

Small packing into the tins ϕ 0.0 x 40 mm
content approx. 60.0 g

1 ton of concentrated tomato juice = 12,500 pcs.
of tins.

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PRODUCTION STANDARD NO.3:

TOMATO KATCHUP STERILIZED:

Analytical values of ready product : Brix^o = 38.0, pH 3.6 - 3.9

Packing : Bottle, content 10 oz = 283.48 nett.

Planning unit : 1000 kg tomato Ketchup = 1 ton
= 3,528 bottles

Material consumption per 1 ton (approximately data including production losses).

Tomato juice concentrated (Puree) Brix 29 ^o	1,149 kg
Onion fresh peeled and sliced	10 "
Garlick peeled	5 "
Malt vinegar 10%	20 "
Salt (NaCl)	13 "
Sugar	60 "
Stabilizing agent	5 "
Sorbic acid	0.08 "
Glass bottles	3,535 Nos.
Alcork seals (Screw - type)	3,540 "
Labels body & neck	3,545 "
Cardboard boxes (24 pcs each)	149 "
Suspensor grids	149 "
Labels for the cardboard boxes	149 "
Glue strip	92 m
Glue	0.6 kg
<hr/>	
1 ton of ready product	3,528 bottles of Ketchup

...../

PRODUCTION STANDARD NO.4:

A. MANGO JUICE:

B. CONCENTRATED MANGO JUICE:

A. Production of mango juice (natural)

Analytical values of mango juice : Brix 16.0°
Acidity 0.6%

Packing : Tin box 72.8 x 115 mm, nett weight 16 oz
= 453.67 g

Planning Unit : 1,000 kg of juice (1 ton) = 2,204 tins.

Material consumption per 1 ton of mango juice
fresh mango, ripe, Brix 16°, acidity 0.6%

yield 70%	...	1,428 kg
Tin boxes size 72.8 x 115 mm	...	2,210 Nos.
Lids ϕ 72.8 mm	...	2,213 "
Labels	...	2,210 "
Cardboard boxes (24 tins each)	...	92 "
Suspensor grids	...	92 "
Labels for the cardboard boxes	...	92 "
Glue strip	...	92 m
Glue	...	0.6 kg

1 ton of mango juice	...	2,204 tin cans.
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PRODUCTION STANDARD NO.5:

B. CONCENTRATED MANGO JUICE:

Analytical values : Brix 65°
Acidity 2.46%

Packing : Tin box 72.8 x 115 mm
nett weight approx. 595 g *

Planning unit : 1 ton = 1,000 kg = 1,680 tins.

Material consumption per 1 ton of mango concentrated juice.

Mango juice Brix 16°, acidity 0.6%

Theoretical consumption = $\frac{65}{16} = 4.0625$ concentration

$$\frac{x}{1000} = 4.0625$$

$$x = 4.0625 \times 1000 = 4.062 \text{ kg mango juice Brix } 16^\circ$$

$$+ 4\% \text{ loss} = \underline{163 \text{ kg}}$$

Total consumption 4,225 kg mango juice per 1 ton
of concentrated juice 65° Brix.

Quantity of water to be evaporated 3,225 kg water/ 1 ton
of concentrate.

Consumption of fresh mango : 6,033 kg per 1 ton
concentrate 65° Brix.

* Re : nett weight derived : 453.67 x 1.31 gm

...../

Tin boxes size 72.8 x 115 mm	...	1,685 Nos.
Lids ϕ 72.8 mm	...	1,688 "
Cardboard boxes (24 tins each)	...	70 "
Suspensor grids	...	70 "
Labels for the cardboard boxes	...	71 "
Glue strip	...	70 m
Glue	...	0.7 kg
<hr/>		
1 ton of concentrated juice	...	1,680 tins cans.
<hr/>		

PRODUCTION STANDARD NO. 6:

MANGO PULP IN SYRUP:

Resulting analytical values : Brix 20°

Acidity 0.6 - 0.7%

Packing : Tin box 99 x 118 mm

Weight of the fresh fruit	.....	530 g
Weight of the sugar syrup	.....	320 g
Nett weight of the content	.....	850 g

Planning unit : 1 ton (metric) = 1,000 kg

Number of Cans = 1,176

Material consumption per 1 ton of ready product (including production losses)

Tin boxes size 99 x 118 mm	....	1,188 Nos.
Lids ø 99.00 mm	....	1,194 "
Fresh mango, variety FAZLI, yield 70%, Brix 15.5°, acidity 0.6%(citric acid)	....	890 kg
Sugar syrup 27.45° Brix 376.3 kg, 100% sugar		103.2 kg
Citric acid	....	3.23 "
Labels	....	1,188 Nos.
Cardboard boxes (12 tins each)	....	99 "
Glue	....	0.7 kg
Suspensor grids	....	99 Nos.
Glue strip	....	99 m
Labels for the cardboard boxes	....	100 Nos.

1 ton of ready product = 1,176 Cans

.....

PRODUCTION STANDARD NO.7

LITCHI PULP IN SYRUP:

Resulting analytical values : Brix 20.00°

Acidity 0.7%(Citric acid)

Packing : Tin box 99 x 118 mm

Weight of fresh fruit	....	530 g
Weight of sugar syrup	....	320 g
Nett weight of the content	.....	850 g

Planning unit : 1 ton (metric) = 1,000 kg

Cans = 1,176 Nos.

Material consumption per 1 ton of ready product(including production losses)

Tin boxes size 99 x 118 mm	...	1,188 Nos.
Lids ϕ 99.00 mm	...	1,197 "
Fresh Litchi fruit, yield 68%, Brix 14%, citric acid 0.28%	...	916 kg
Sugar syrup 30° Brix 385 kg, sugar 100%	...	115.50 kg
Citric acid	...	5.23 kg
Labels	...	1,188 Nos.
Cardboard boxes (12 tins each)	...	99 "
Glue	...	0.7 kg
Suspensor grids	...	99 Nos.
Glue strip	...	99 m
Labels for the cardboard boxes	...	100 Nos.

1 ton of ready product = 1,176 Cans

...../

PRODUCTION STANDARD NO.8:

FRUIT DESERT IN SYRUP:

Size of cubes : 9.5 x 9.5 x 9.5 mm

Resulting analytical values : Brix 20°

Acidity 0.7%

Packing : Tin box 99 x 118 mm

Nett weight of the fresh fruit	....	520 g
Weight of the sugar syrup	....	330 g
Nett weight of the content	....	850 g

Planning unit : 1 ton (metric) = 1,000 kg
Cans = 1,176 pcs.

Material consumption per 1 ton of ready product (including production losses).

Tin boxes size 99 x 118 mm	...	1,188 Nos.
Lids ø 99.00 mm	...	1,194 "
Consumption of fresh fruit mixture : 1176 x 520	...	611.60 kg
33% fresh Litchi yield 68%, Brix 14°, acidity 0.28%	...	297 kg.
37% fresh banana, yield 70%, Brix 15°, acidity 0.1% *	...	297 kg
33% fresh papaya, yield 55%, Brix 16°, acidity 0.2%	...	366 kg

Peeled and diced fresh fruit consumption:

Litchi destoned	201.80 kg
Banana in cubes	208 "
Papaya in cubes	201.80 "
Total	<u>611.60 kg</u>

Sugar syrup 28° Brix 388 kg = Sugar 100%	....	108.70 kg
Citric acid	....	2.84 kg

* Values estimated : Exact data were not available.

..../

Labels	...	1,188 Nos.
Cardboard boxes (12 tins each)	...	99 "
Glue	...	0.7 kg
Suspensor grids	...	99 Nos.
Glue Strip	...	99 m
Labels for the cardboard boxes	...	100 Nos.

1 ton of ready product		1,176 Cans
------------------------	--	------------

PRODUCTION STANDARD NO.9:

CUCUMBER SLICES IN SOUR-SWEET BRINE, STERILIZED:

Thickness of sliced cucumbers : 3 mm

Resulting analytical values : Nacl 1.0%

Acetic acid 0.9%

Sugar 4.0%

Packing : Tin box 99 x 118 mm

Nett weight of sliced cucumbers 510 g

Nett weight of brine 360 g

Nett weight of the whole content 870 g

Planning unit : 1 ton (metric) = 1,000 kg

Number of tins = 1,149

Material consumption per 1 ton of ready product
(including production losses)

Tin boxes size 99 x 118 mm	....	1,150 Nos.
Lids \emptyset 99.00 mm	....	1,152 "
Fresh sliced cucumbers including production loss	....	630 kg
Brine 423 kg = Sugar	....	41.0 kg
Salt	....	10.3 kg
Spirit vinegar	....	92.0 L
Blend of spices approx	....	1.0 L
Labels	....	1,150 Nos.
Cardboard boxes (12 tins each)	....	96 "
Glue	....	0.7 kg
Suspensor grids	....	96 Nos.
Glue strip	....	96 m
Labels for the cardboard boxes	....	97 Nos.

1 ton of ready product = 1,150 Cans

PRODUCTION STANDARD NO.10:

READY MEAL "PILAF"

Resulting analytical values : Nacl 1.0%

Packing: Tin box 99 x 118 mm
Nett weight 850 g

Planning unit : 1 ton (metric) = 1,000 kg
 number of cans = 1,176

Material consumption per 1 ton of ready product(including production losses)

Tin boxes size 99 x 118 mm	...	1,188 Nos.
Lids ϕ 99.00 mm	...	1,197 "
Rice 83% boiled 830 kg, Dry rice (219.0% yield)	...	379.0 kg
Oil (Vegetable 2.5% 25 kg	...	25.0 kg
Onion 0.5% 5 kg	....	6.5 kg
Carrot 8% 80 kg	....	86.4 kg
Peas green 5% 50 kg	....	51.0 kg
Salt edible (Nacl) 11 kg	....	11.0 kg
1001 kg.		
Blend of spices	....	0.3 kg
Labels	....	1,150 Nos.
Cardboard boxes (12 tins each)	....	96 "
Glue	....	0.7 kg
Suspensor grids	....	96 Nos.
Glue strip	....	96 m
Labels for the cardboard box	....	97 Nos.

1 ton of ready product 1,176 Cans

SUPPORTING PRODUCTION STANDARD NO.11:

Reconditioning of flattened tins (Cans):

Measures of tins : 1) 99 x 118 mm
2) 72.8 x 115 mm

Planning unit : 1,000 numbers of Cans

Tin bodies	--	1,002 Numbers.
Bottom Seals	---	1,003 "

...../

MATERIAL HANDLING:

a. Raw material - Fruit:

Generally all material handling inside of the plant will be performed by means of timber pallets or metal box pallets alternatively and moved by pallet trucks.

The fruits and vegetables will be loaded in the collecting centres in the truck and either directly transported into the processing unit, or transloaded into the railway and dispatched by railway siding into the plant.

All fruits and vegetables will be principally packed in uniform wooden crates, size 600 X 410 X 370 mm, content 15 - 20 kg each. The farmers will transport their fruits and vegetables to the collecting centres, where the fruit will be sorted out, put into the wooden crates. By means of installed scale, uniform weight of each crates will be adjusted. The technician of the production unit will take over the raw material as to the quality and quantity. The fruit will be afterwards loaded on the trucks and dispatched into the plant.

In the plant the stock-keeper will take over the fruits-vegetables checking the weight and also quality. Crates will be loaded on wooden pallets and by means of electric fork lift trucks or hand operated lift trucks dispatched into the sorting room or storage.

b. Means of transportation:

In order to spare the space when keeping the material on stock, in principle pallets will be used inside the plant.

..../

c. Ingredients and chemicals:

Ingredients and chemicals will be stored in separate stores, equipped with racks from profiled steel. Sugar and citric acid will be piled on timber pallets.

d. Packing material:

The largest volume of packing material represent metal boxes, that will be transported in flattened form. Cans will be packed in returnable plywood or cardboard boxes. Glass jars and lids will be delivered also in cardboard boxes fixed inside with wood fibres against breakage.

Packing material:

The biggest volume of packing material represent metal boxes (Cans) that will be packed in flattened form into returnable plywood or cardboard boxes.

Glass jars and lids (corks) will be delivered also in cardboard boxes fixed inside with wood fibres against breakage.

Metal lids will be delivered also in cardboard boxes.

STOCKING:

Raw material - Fruits:

The need of fruit for one day production will be stored in the open shed in the front part of sorting room.

The quantity of fresh fruit to cover 2 days production that should be stored will be 76,340 kg.

The fruit will be stored on timber pallets in wood crates of uniform size double piled pallets.

1 pallet will hold 12 crates per 20 kilo = 240 kilo of fresh fruit.

1 pallet size 80 x 120 cm takes 1.20 m^2 space.

The storage capacity of 1 stack double piled pallets takes 480 kg.

Storage area with double stacked pallets need 190 m^2

The nett height of the open shed for storing of fresh fruit should be 365 cm

Except this there will be a cooled store with a capacity of 230 tons to balance the irregularities in the supply with fresh fruit/vegetable.

The Cold Store:

The fresh fruit will be also stored in wooden crates, each 20 kilo.

1 pallet will hold 12 crates = 240 kilo of **fresh** fruit.

The main aim is to balance the irregularities in supply of fresh fruit and vegetable with this production unit.

The height of the loaded pallet takes 152 cm

3 piled pallets result 4.56 m height

Plus $\frac{0.50 \text{ m handling space}}{5.06 \text{ m}}$
Needed height :

With an area 1.20 m^2 ($0.80 \times 1.20 \text{ m} + 25\%$) there will be stored 720 kg of fruit.

Projected total space : area $318 \text{ m}^2 \times 5.0 \text{ m} = 1,590 \text{ m}^3$

The stocking capacity will take 230 tons of fresh fruits and vegetables.

Needed temperature : $+ 7^\circ \text{C}$, Relative humidity 85%
air change 2 times/24 hours.

..../

Ingredients and chemicals:

Sugar : Only in-process store with the capacity of 10,000 kg sugar will be there.

The sugar will be stored in bags of 100 kg nett.

The supply of 10 tons of sugar will cover the production demand for 20 days.

1 pallet holds 600 kg of sugar

1 stack = 2 piled pallets = 1,200 kg = 1.12 m² space.

Needed space for 10 tons of sugar = 9.33 m²
 plus 25% = 2.33 m²

Total area needed : 11.66 m² ≈ 15 m²

Citric acid : Packed in PE bags of 50 kg

projected supply : 5,000 kg

1 stack = 2 piled pallets = 1,200 kg
 = 1.12 m² space.

Needed space for 5 tons of citric acid = 5.36 m²

plus 25% = 1.34 m²

Total need : 6.70 m² ≈ 10 m²

Glue : Packed in drums of 100 kg

projected supply : 1,500 kg

1 m² = 200 kg

Needed are : 7 m² + 25% ≈ 10 m²

Spare parts store : Projected area : 20 m²

Necessary area for stocking ingredients, chemicals and Spares:

Summary:

Sugar 15.0 m²

Citric acid 10.0 m²

Spare parts and technical material .. 20.0 m²

Glue 10.0 m²

Total : 55.0 m²

Height of the store 4.00 m (minimum). /

Packing material:

No extra store area will be needed. All packing material will be stored in the store of ready products.

Stocking of ready products:

Means of stocking:

Dry cans will be dispatched in the stock of ready products, labeled, packed into cartons, piled on the timber pallets and stacked : 1 pile = 4 pallets.

The storage capacity is calculated to keep on stock 73% of all products of the main season : that is

Mango juice concentrated	...	203 tons
Mango pulp in syrup	...	738 "
Litchi pulp in syrup	...	492 "
Fruit desert in syrup	...	246 "
Cucumbers sterilized	...	476 "
Total :		2,155 tons

It is calculated, that within the season the market will be fluently supplied from the stock of ready products and also goods for export will be delivered. At least 27% should be delivered from the stock of ready products, so that all products of the main season, that is 2,155 tons can be taken on stock. Continuous release of ready products from stock will enable further production, like ready meals and products from tomatoes could be taken on stock.

To project the full stock capacity of the whole production would not be economical.

...../

As mentioned above, the storage technology is projected with application of

Timber flat pallets size 80 x 120 cm

Capacity of one pallet : tins size 99 x 118 mm

1. 6 cardboard boxes each 12 pcs of

tins 99 x 118 mm in one shift	.....	72 tins
Number of shifts 1 pallet	.....	8
Number of cardboard boxes/pallet	.....	48
Number of all Cans/Pallet	.....	576
Necessary area for one pallet	.....	1.12 m ²
Number of stacked loaded pallets	....	4
Capacity of one stack = 4 pallets	.....	2,304 cans.
Stocking capacity	....	1,958.4 kg
Minimum height of the store	.....	5.4 m

2. Capacity of one pallet - tins size 72.8 mm x 115 mm

6 cardboard boxes each 24 pcs of cans

dia 72.8 mm x 115 mm 1 shift	....	144 tins
Number of shifts 1 pallet	....	8
Number of cardboard boxes/pallet	....	48
Number of all Cans/Pallet	....	1,152
Necessary area for one pallet	....	1.12 m ²
Number of stacked loaded pallets	....	4
Capacity of 1 stack = 3 pallets	....	4,608 Cans
Stocking capacity : 4,608 x 0.453.6	....	2,090 kg
Minimum height of the store	....	5.4 metre.

...../

Survey about the size of tins being processed in course
of the main season :

Mango juice concentrated	tins (72.8 x 115 mm)
Mango pulp	" (99 x 118 mm)
Litchi pulp	" (99 x 118 mm)
Fruit desert in syrup	" (99 x 118 mm)
Cucumbers	" (99 x 118 mm)

Projected storage capacity :

Summary : 203 tons tins (72.8 x 115 mm)
1876 tons tins (99 x 118 mm)

Necessary area for stocking:

203 tons	$\frac{203,000}{2090}$	= 97 x 1.12	= 108.0 m ²
1,876 tons	$\frac{1,876,000}{1,958}$	= 958 x 1.12	= 1,072.0 m ²
			<u>1,180.0 m²</u>
Plus 28.8% roads and handling area			<u>340.0 m²</u>
Store of ready products area total :			1,520.0 m ²

...../

PRODUCTION SCHEME NO. 1 - 12

MAN POWER DEMAND

MANPOWER DEMAND:

PRODUCTION SCHEME NO.1:

MANGO JUICE:

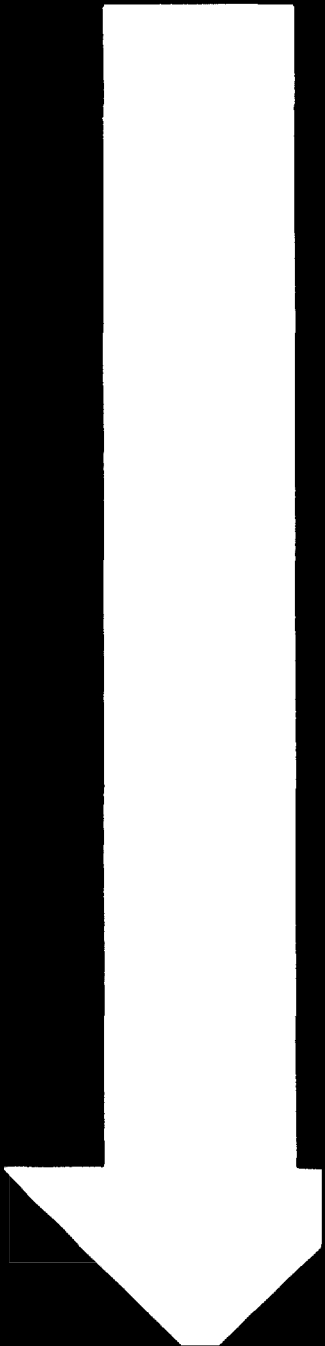
	<u>Natural</u>	<u>Concentrated</u>
Sorting of fruit	4	4
Washing 2,140 kg/hour	2	2
Inspection Belt	3	3
Crushing Unit	1	1
Screening/sieving	1	1
Pre-heater	1	1
Evaporating unit	-	2
Hot filling(syruper)	2	2
Washing of Cans	2	2
Lids	2	1
Seaming	2	1
Spray cooling	1	-
Drying of Cans	1	1
Anticorrosion treating	4	2
Labeling	4	2
Packing	6	3
Palletisation	3	2
	<hr/>	<hr/>
	39	30
Foreman	2	2
	<hr/>	<hr/>
	41	32
Peeling and destoning of fruit (manually)	142	142
	<hr/>	<hr/>
Total	183	174

MANPOWER DEMAND:

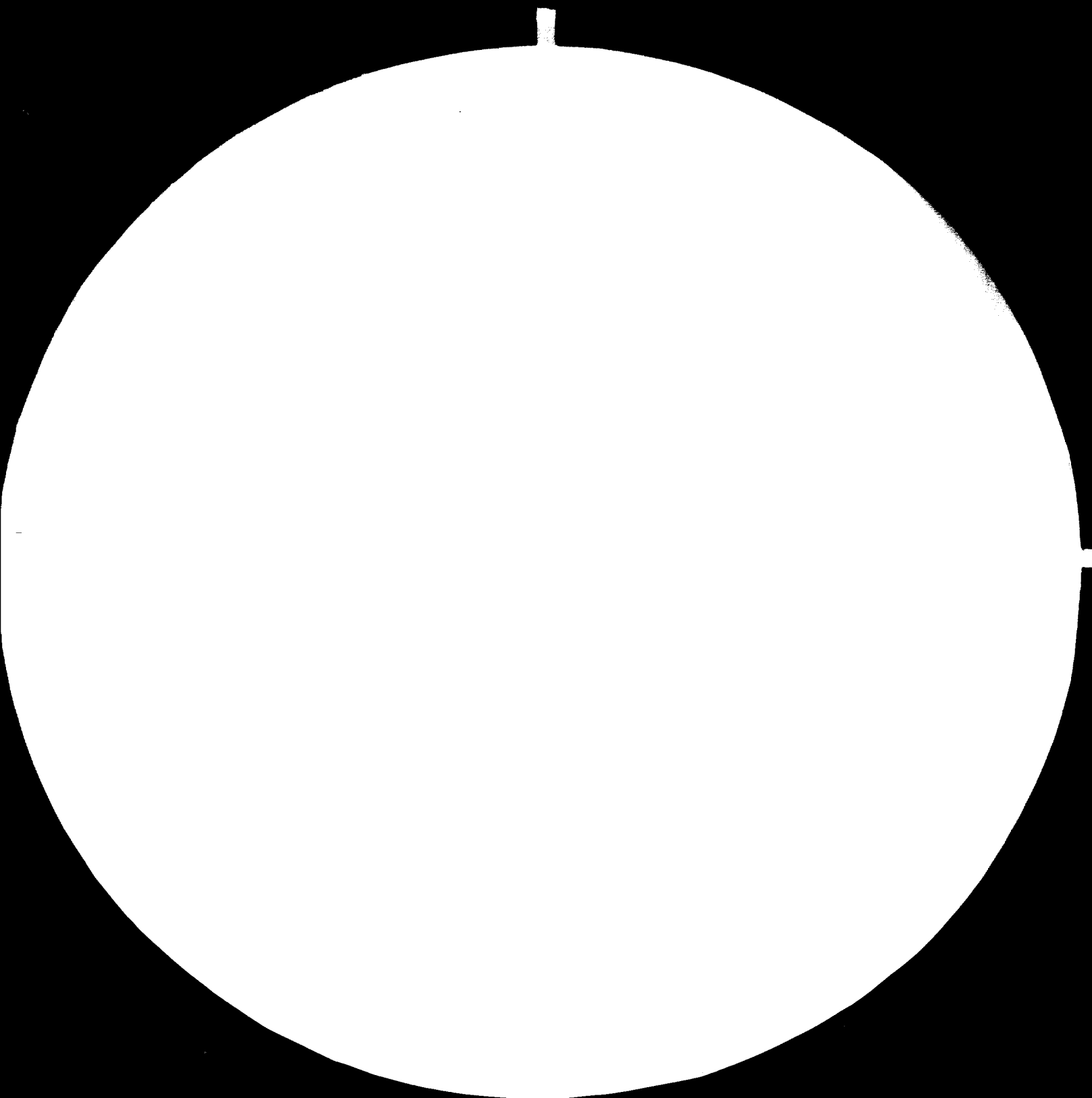
PRODUCTION SCHEME NO. 1a:

TOMATO JUICE:

	<u>Natural</u>	<u>Concentrated</u>
Sorting of fruit (Sorting belt)	8	8
Washing	4	4
Inspection belt	4	4
Shower	1	1
Crushing	1	1
Screening, sieving	1	1
Pre-heater unit	1	1
Evaporating unit	-	2
Hot filling(syruper)	2	2
Washing of Cans	2	2
Lids	2	1
Seaming	2	1
Spray cooling	1	-
Sterilization	-	1
Drying of Cans	1	1
Anticorrosion treating	4	2
Labeling	4	2
Packing	6	3
Palletisation	3	2
	<hr/>	<hr/>
	47	39
Foreman	2	2
	<hr/>	<hr/>
Total	49	41



81-1207





0.45
μm



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

MANPOWER DEMAND:

PRODUCTION SCHEME NO.2:

TOMATO KATCHUP IN BOTTLES:

	<u>Workers</u>
Production of concentrated juice Brix 29°	22
Evaporating unit	2
Ingredients preparation	2
Washing of Bottles	2
Filling of Bottles	2
Sealing	2
Sterilization	1
Drying of bottles	1
Labeling	2
Packing	3
Paletisation	2
	<hr/>
	41
Foremen	2
	<hr/>
Total	43
	<hr/>

MANPOWER DEMAND:

PRODUCTION SCHEME NO.3:

LITCHI PULP IN SYRUP STERILIZED:

		<u>Workers</u>
Sorting of fruit	---	6
Washing	---	4
Peeling and destoring	---	171
Washing	---	4
Sorting	---	4
Packing	---	14
Filling with sugar syrup	---	1
Deaeration	---	1
Setting of lids	---	1
Sealing	---	2
Piling into sterile crates	---	2
		<hr/>
		210
Chief	---	1
Foreman	---	2
		<hr/>
Total :		213

Remark : From that 171 workers will be employed for manual peeling.

MANPOWER DEMAND:

PRODUCTION SCHEME NO.4:

FRUIT DESERT IN SYRUP STERILIZED:

		<u>Workers</u>
Grading, sorting of fruit	—	2
Washing	—	2
Peeling of Papaya, Banana, Mango	—	38
Dicing	—	2
Sorting	—	6
Weighing latches, milling	—	2
Washing tins	—	2
Filling cans with fruit	—	7
Filling with sugar syrup	—	1
Deaeration	—	1
Snap of the lids	—	1
Sealing	—	2
Piling into the sterile crates	—	2
		<hr/>
Workers	—	66
Foreman	—	2
		<hr/>
Total Manpower :		68
		<hr/>

MANPOWER DEMAND:

PRODUCTION SCHEME NO.5:

MANGO PULP IN SYRUP STERILIZED:

Workers:

Sorting of fruit	---	6
Washing	---	4
Peeling and destoning	---	89
Slicing	---	2
Sorting	---	4
Filling	---	7
Filling of sugar syrup	---	1
Deaeration	---	1
Snap of lids	---	1
Sealing	---	2
piling into sterile crates	---	2
		<hr/>
Workers		119
Foreman	---	2
		<hr/>
Total :		121

MANPOWER DEMAND:

PRODUCTION SCHEME NO.6:

SLICED CUCUMBERS IN SOUR SWEET BRINE:

		<u>Workers:</u>
Sorting of fruit	---	4
Advance dipping	---	2
Washing	---	2
Cross cutting	---	2
Washing of Cans	---	2
Sorting	---	4
Filling of spices	---	2
Filling slices	---	12
Filling of brine	---	1
Deaeration	---	1
Snap of the lids	---	1
Seaming	---	2
piling into sterilecrates	---	2
		<hr/>
Workers	---	37
Foreman	---	2
		<hr/>
Total	---	39

MANPOWER DEMAND:

PRODUCTION SCHEME NO.7:

READY MEAL "PILAF":

		<u>Workers:</u>
Peeling/dicing of carrots	---	20
Peeling/dicing of onion	---	2
Bleeding of peas	---	1
Cooking rice	---	2
Weighing of latches	---	1
Miling of ingredients	---	2
Filling of Cans	---	8
Setting of Lids	---	1
Sealing	---	2
Piling into sterile crates	---	2
		<hr/>
		41
Foreman	---	2
		<hr/>
Total Man-power	---	43

MANPOWER DEMAND:

PRODUCTION SCHEME NO.8:

SUGAR SYRUP PREPARATION:

		<u>Workers:</u>
Operator	---	1
Assistant	---	1

Total	---	2 workers (trained).

MANPOWER DEMAND:

PRODUCTION SCHEME NO.9:

SOUR-SWEET BRINE PREPARATION:

		<u>Workers</u>
Operator	—	1
Assistant	—	1
		—
Total	—	2 trained workers.

MANPOWER DEMAND:

PRODUCTION SCHEME NO.10:

RECONDITIONING OF FLATTENED CANS:

		<u>Workers</u>
Rolling machine operator	---	3
Seamer operator	---	3
		<hr/>
Total	---	6
<hr/>		

MANPOWER DEMAND:

PRODUCTION SCHEME NO.11:

STERILIZATION OF PRODUCTS:

		<u>Trained workers</u>
Retort operator	---	1
Assistant	---	1

Total	---	2 trained workers

		<u>Workers</u>
Drying of Cans	---	2
Oiling of Cans	---	6

Total	---	8

MANPOWER DEMAND:

PRODUCTION SCHEME NO.12:

STORAGE OF READY PRODUCTS:

		<u>Workers</u>
Labeling	---	4
Packing	---	4
Packing into cardboard boxes	---	6
Piling on pallets	---	4
Storing in piles	---	2

Workers	---	20
Foreman	---	1

Total	---	21

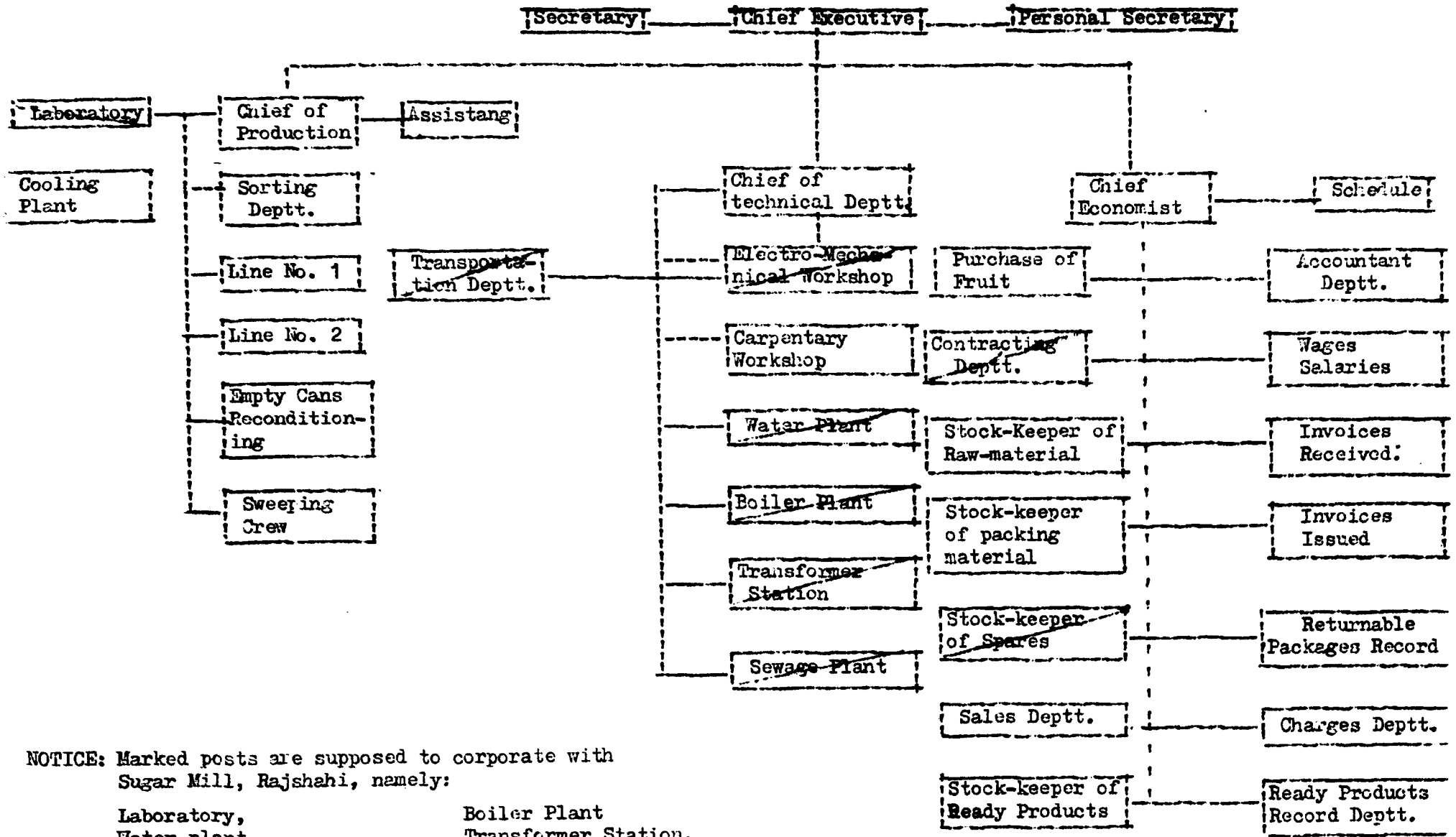
PLANT ORGANISATION.

ORGANISATIONAL SCHEME.

PRODUCTION CAPACITY.

MAN POWER DEMAND.

ORGANIZATIONAL CHART



NOTICE: Marked posts are supposed to corporate with Sugar Mill, Rajshahi, namely:

Laboratory,
Water plant,
Electro-mechanical workshop,
Transportation Department,
Water Plant,

Boiler Plant
Transformer Station,
Sewage Plant,
Contracting Deptt.
Stock-keeper of Spares.

**PRE-FEASIBILITY STUDY
FRUITS AND VEGETABLES
PROCESSING UNIT, RAJSHAHI**

TABLE NO.

PRODUCTION CAPACITIES AND MAN POWER DEMAND:

Production Scheme No.	Production Scheme	CAPACITY/HOUR		MANPOWER DEMAND		
		Pcs Cans Bottles	Tons	Workers	Fore-man	TOTAL
1	Tomato Juice					
	Natural	3300	1.5	47	2	49
	Concentrated	696	0.355	39	2	41
	Mango Juice					
	Natural	3300	1.5	181	2	183
	Concentrated	696	0.355	172	2	174
2	Tomato Ketchup Bottles	1,254	0.355	41	2	43
3	Litchi pulp in syrup	1,764	1.5	210	3	213
4	Fruit Desert in syrup	1,764	1.5	64	2	66
5	Mango pulp in syrup	1,464	1.5	119	2	121
6	Slices Cucumbers	1,149	1.0	37	2	39
7	Ready Meal	588	0.5	41	2	43
<u>SUPPLEMENTARY SCHEMES:</u>						
8	Sugar syrup preparation	-	0.9	2	-	2
9	Sour Sweet Brine preparation	-	0.8	2	-	2
10	Reconditioning of flattened Cans	4,100	Cans	6	-	6
11	Sterilization Cans	3,300	1.5			
	Bottles	697	0.355	2	-	2
	Drying of Cans, oiling			8	-	8
12	Storage of ready products (3300 + 1764)	5,070	3.0	20	1	21

LAYOUT OF THE

PRODUCTION PLANT

Legend to the layout of the production plant

1. Sorting Area - open shed with
 - 1a Area for storing of fresh fruit
2. Production lines No.1, 1a(Ketchup) and Line No.11 with sterilization retorts.
3. Storage of ready products and packing material, Reconditioning of empty cans.
 - 3a Ramp
4. Cooling plant
5. Storage of spares and technical material
6. Storage of sugar and chemicals
7. Laboratory
8. Scale

Production building along with store

is projected as a ferrocconcrete ground floor monoblock. Weather conditions permit to erect the building as a light weight construction which inturn will favourably influence on the erection costs.

Floors : Striked concrete with dilatation joints, declinity approximately 1% to catch drain.

Drains : Should be constructed against penetration of insect from outside.

Roofing: Monitor roof.

Ventilation : By Exhaustor's installed in the monitors.
Capacity : 2 x air change/hour.

Windows : Protected by nets against insect.

The sorting room : Open shed on steel collums supporting the steel framed roof.

Roofing : Transite desks, or corrugated sheets.

Floor : Striked concrete with dilatation joints, declinity approximately 1½%.

Drainage : All sewage water will be lined into the sewage plant for treating.

CONCLUSIONS:

In the initial stage of this project, all production feasibilities enabling maximum utilisation of the fruits and vegetables growing in and around Rajshahi has been chalked out. Hence, specific stress has been given on Mango, Litchi and Tomatoes - which grow in abundance in this region.

It is suggested that from Mango, Mango Juice (natural) and concentrated Mango Juice (65° Bx) will be produced. Similarly, from Tomato, Tomato Juice (natural), Tomato puree (concentrated i.e. of 29° Bx) and Tomato Ketchup will be produced. Ketchup will be processed in a branch line. To materialise this production, a combined production line No. 1 with relevant production capacities has been projected.

Production line No. 2 will produce :

Litchi Pulp in syrup sterilized,

Mango Pulp in syrup sterilized,

Fruit desert (cubed fruit cocktail) in syrup sterilized,

Sliced cucumbers, vegetable salads and other vegetables(diced),

Further, this line can be utilised for the production of some ready meals from rice, vegetable and other raw-materials.

The production lines have been projected with maximum versatility to minimise the production floor space and costs for machinery and equipment.

All products that will be produced in this unit are supposed to be filled up into cans except Tomato Ketchup, that will be filled up into bottles.

The cans for this purpose will be procured from the new can making and tin printing plant of BSFIC in Chittagong, either by railway or by trucks in flattened form, to cut the transport costs and storage space. In this projected plant cans will be reconditioned and made fit for filling.

...../

The Cold Store can be used as a store for ready products, after the completion of main production season.

The availability of fruits and vegetables in the region enables to run the plant for more than six months. In future if Ready Meals are also produced in this projected plant, it will be possible to extend the production period to nearly whole of the year, and that would be most desirable from the economic point of view.

The advantages of establishing this unit near Rajshahi Sugar Mills will be further clear after complete economical evaluation of this study.

To get a detail information about the machinery and equipment for this plant, well known producers all over the world were contacted through letters. Respective catalogues will be handed over in a separate report. List of the producers contacted are shown in the annexure No.2.

It is recommended that prior to the starting of actual production in the projected plant, technological tests of all products accepted under production programme should be performed separately. Especially, the exact weight of the raw materials required for the production of a definite quantity of finished product, production losses which may occur and the analytical values of the fruits and vegetables should be thoroughly checked. The actual time required for proper sterilisation of the fruits and vegetables, keeping an eye over the physical properties of the raw-materials and the 'K' factor (Killing factor for micro-organism) should be fixed in advance.

In the next stage of projection the feasibility of utilization of the kernels from Mango stones (used in the unit) should be considered. It may be mentioned here that the mango kernels contain about 13% of vegetable oil that could be used in future for technical purposes. It is presumed that within one production season about 160 tons of mango kernels will be

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available and from which approximately 20,000 kg of vegetable oil could be extracted. It may be stated here that there is an extraction unit in Chittagong.

Although certain steps of production will be performed manually, still the projected technology enables to maintain the export standard.

The writing work of this pre-feasibility study was started on 28th September and finished by 18th October, 1978.

Jiri V. Skala
Food Industry Specialist
to UNIDO

ANNEXES

No. 1

Quality standard for drinking water.

The below mentioned values were taken from Czechoslovak Quality standard for Drinking Water CSN 330611 from 27.3.1974 that correspond with that of WHO (World Health Organisation, approved in Geneva on 1963 and 1971).

Bacteriological and Biological demands:

1. The drinking water must not contain any pathogenic microorganism.
2. Coliform Bacteria - 100 ml sample of the drinking water must not contain any coliform bacteria.
3. Mesophil Bacteria - One millilitre sample of drinking water must not contain more than 20 numbers of Mesophil Bacteria.
4. Microscopic Picture:
The drinking water must not contain any microscopic or macroscopic organism.
5. Psychrophilic Bacteria:
One millilitre sample of drinking water may contain maximum 200 numbers of Psychrophilic Bacteria.
6. Enterococcus: One 100 millilitre sample of drinking water must not contain any Enterococcus.

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The Chemical and physical demands:

The maximum quantity of elements and chemicals that are allowed:-

1. Mercury : Maximum 0.001 mg/L Hg
2. Selenium : Maximum 0.01 mg/L Se
3. Cadmium : Maximum 0.01 mg/L Cd
4. Vanadium : Maximum 0.01 mg/L V
5. Chromium : Maximum 0.05 mg/L Cr
6. Arsenic : Maximum 0.05 mg/L As
7. Silver : Maximum 0.05 mg/L Ag
8. Lead : Maximum 0.05 mg/L Pb
9. Copper : Maximum 0.05 mg/L Cu
10. Barium : Maximum 1.5 mg/L Ba
11. Cyanides : Maximum 0.01 mg/L CN⁻
12. Hydrogen Sulphide: Max. 0.01 mg/L H₂S
13. Fluorides : Maximum 0.5 mg/L F⁻
14. Phenols : Maximum 0.05 mg/L
15. Crude oil and its derivatives : Maximum 0.01 mg/L
16. Oxidability : Maximum 3 mg/L O₂

The colour and taste of drinking water:

The drinking water must be odour colour and taste less.

Turbidity: Maximum 5 mg S102/1 L of drinking water.

Radioactivity : Total alfa - activity maximum 3 pCi/L
Total Beta - activity maximum 30 pCi/L

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Dissolved oxygen : min. 50% saturation.

Chlorine(active) drinking water being treated with chlorine
min. 0.05 mg/L, maximum 0.3 mg/L Cl_2

Ammonia and its ions : maximum 0.5 mg/L NH_4

Iron : maximum 0.3 mg/L Fe

Manganese : maximum 0.1 mg/L Mn.

Aluminium : only with drinking waters treated by aluminium
salts; maximum 0.3 mg/L Al

Zinc : maximum 5 mg/L Zn

Magnesium : maximum 125 mg/L Mg

Hardness of drinking water:

2.9 - 4.3 mval/l, that is 8 - 12° German Degrees.

pH : pH 6 - 8

Phosphates : maximum 1 mg/L PO_4

Nitrites : maximum 0.1 mg/L NO_2

Chlorides : maximum 100 mg/L Cl

Sulphates : maximum 250 mg/L SO_4

Total dissolved substances maximum 1000 mg/L

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LIST OF ADDRESSES COMMUNICATED

<u>Name of the Office</u>	<u>Date of Communication</u>	<u>Subject in brief</u>
1. F.M.C. Corporation, Food Machinery International Jan Jose, California, U.S.A.	6.7.78	Processing Machines for Canning Industry.
2. Fryma A.C. Rheinfelden, Switzerland.	6.7.78	- do -
3. Koruma - Maschinenbau, 7844 Neuenburg/Baden, Fischerjter. 13. G.F.R.	6.7.78	- do -
4. Demac Duisdurg, ATB. Benchiser - Wassertechnik Schriesheim German Federal Republic.	8.7.78	do -
5. Tecater, Hogannas, S-263 01 P.O. 70 Sweden.	11.7.78	Kjeldhe Analysis System I Macro, II Macro, III Macro.
6. Juwa AG, Zurich, Anemonenstrasse Ch - 8047, Zurich.	11.7.78	Evaporators, Heat Exchangers Sterilishing Units etc.
7. Komen Kuin, B.V.Noordscharwoude, Holland.	12.7.78	Fruit and Vegetable Processing Machines.
8. Lubeca Machinen U Anlagen GMBH P.O. Bxx 1229, Lubech, German Federal Republic.	12.7.78	Retorts LK 3003.
9. A.V.P. Company Ltd. Manor Roual, Crawley, Sussex RH 10 2 QB England.	12.7.78	Evaporating Units.
10. Urschel Laboratories Inc. Valparaiso, Indiana U.S.A.	12.7.78	Veg. and Fruit Processing Machines.

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| 11. Messrs Hannibal, Pumpenfabrik
4, Dusselderf 1,
Farberstressel 84, G.F.R. | 11.7.78 | Transportation of Fish,
Fruit Veg. etc. |
| 12. Wiegand Karlsruhe GMBH
Ettlingna, Einsteinstr-9-15
G.F.R. | 11.7.78 | Information and Catalogue etc. |
| 13. Usine De Wecker S, Ar.L.
Wecker, Luxemburg. | 12.7.78 | Pressing Machines. |
| 14. Breitner Abfullanlagen K6,
7070 Schwabischhall, Postfach
147, G.F.R. | 15.7.78 | Filling Machines for
Ketchup. |
| 15. Bucher - Guyer Ltd.
Engineering Work
Niederweningen 2h,
Switzerland. | 15.7.78 | Machines for Fruit
Juice Extraction. |
| 16. Heinrich Frings,
O-5300 Bonn 1
Jagerstrasse 9,
German Federal Republic. | 14.7.78 | Fruit and Vegetable
Processing Machines. |
| 17. A. Herbert,
Braunschweig 33,
Hamburger STR 268,
G.F.R. | 15.7.78 | Fruit and Vegetable
Processing Machines. |
| 18. Gevetex, Textilglas GMBH,
4000 Dusselderf,
1, Grafenberger Allee 115,
G.F.R. | 11.7.78 | Information and Catalogue
Processing Machines. |
| 19. The Pfaudier Co.
Dept. Fp - 54,
Rochester, New York, U.S.A. | 11.7.78 | Continual Processing of
Fruit Juice from Mangoes |
| 20. Kirchfeld GMBH,
Food Technology Section,
Konigsallee 17, 4, Dusseldorf 1,
G.F.R. | 20.7.78 | Veg. Oil Processing
and Refining Units. |

