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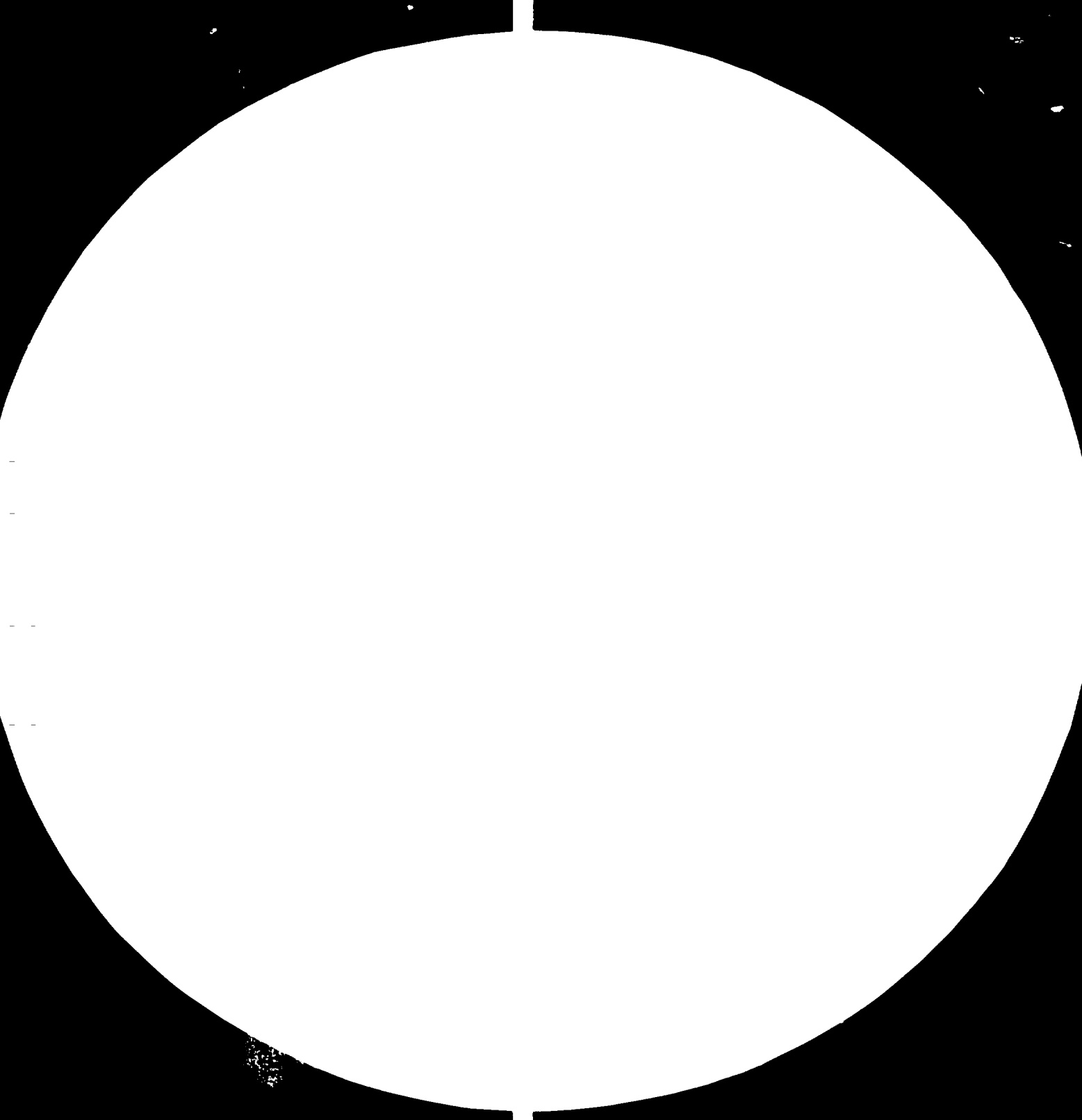

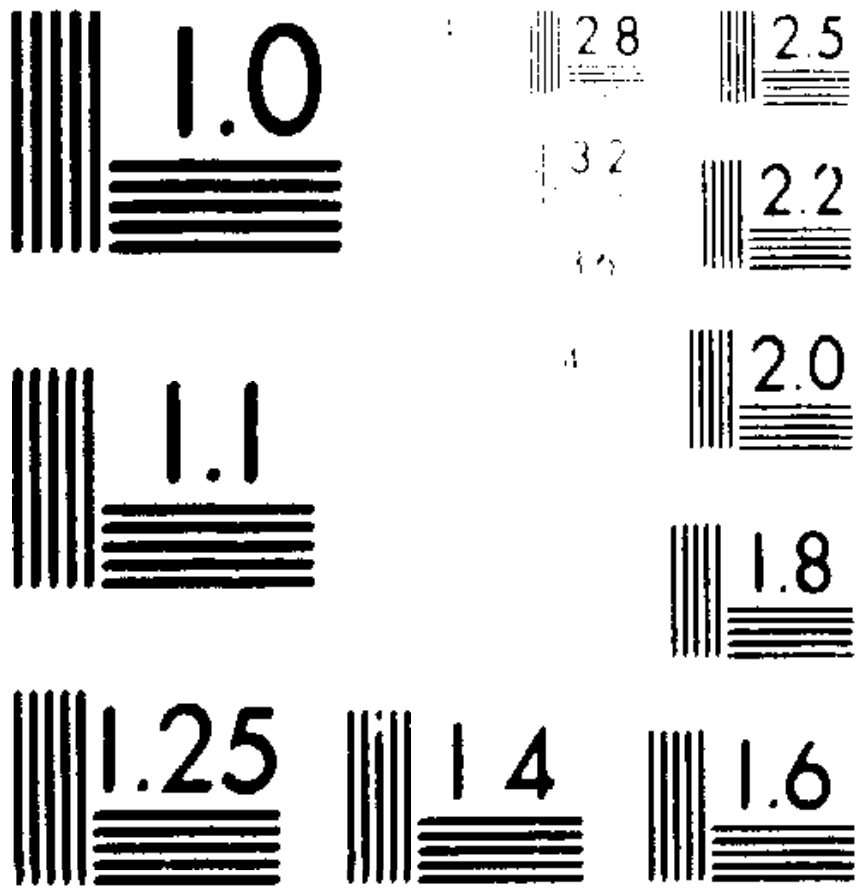
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PRE-FEASIBILITY STUDY

ON

PINEAPPLE PROCESSING PLANT

RANGAMATI

CHITTAGONG HILL TRACTS

BANGLADESH

000.82

DACCA, SEPTEMBER 1978

PRE - FEASIBILITY STUDY

ON

PINEAPPLE PROCESSING PLANT

RANGAMATI

CHITTAGONG HILL TRACTS

BANGLADESH

FOR

BANGLADESH SUGAR AND FOOD INDUSTRIES CORPORATION

DACCA

Dacca, September 1978

SK/PC/NA

II

THE AUTHOR OF 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, M.Sc, Ph.D, Chief, Planning & Development of BSFIC

and

Mr. M. Aminul Islam, Officer on Special Duty of BSFIC and Local Counterpart of the Specialist.

USED ABBREVIATIONS

BSFIC	-	Bangladesh Sugar & Food Industries Corporation.
UNIDO	-	United Nations Industrial Development Organization.
UNDP	-	United Nations Development Programme
PP	-	Project Proforma
ECNEC	-	Executive Committee of National Economic Council.
ERD	-	External Resources Division
FRG	-	Federal Republic of Germany
BCSIR	-	Bangladesh Council for Scientific & Industrial Research
CHT	-	Chittagong Hill Tracts
BSRS	-	Bangladesh Shilpa Rin Sangstha
BSB	-	Bangladesh Shilpa Bank
WHO	-	World Health Organization

QUANTITIES WEIGHTS - MEASURES

1 Crore	=	10 Millions
1 Lakh	=	100,000
1 Tonne	=	Metric Ton = 1000 Kgs = 2204.6 lbs
1 Maund	=	82.3 lbs = 37.285 Kg
1 Long Ton	=	4928 Kg = 2240 lbs
1 Acre	=	4840 square yards = 0.404 ha

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5. Inter country Corporation in Technology transfer to develop Food and Agricultural Products Processing Industries in Bangladesh, compiled by Dr. N.M.Sheikh, in June 1978.

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10. Estimate of Pineapple of Bangladesh 1976 - 77 by Bangladesh Bureau of Statistics, Agriculture.

11. Review of Researches of the Division of Horticulture, Kamaluddin Ahmed, January,1974.

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PRE - FEASIBILITY STUDY

Pineapples Processing and Canning Unit in Rangamati

Region Chittagong Hill Tracts - Bangladesh

INTRODUCTION

Project Promoter: Bangladesh Sugar and Food Industries Corporation, Shilpa Bhaban, 5th Floor, Motijheel Commercial Area, Dacca.

Location of Project: Rangamati, District Chittagong Hill Tracts.

Project Background: Although some 8,000,000,000 pounds of fruits and vegetables are produced annually in Bangladesh, all of them are seasonal and perishable products. Due to the highly seasonal nature, the fruits and vegetables are being wasted during the time of glut for lack of proper preservation and marketing facilities, It is a national loss. This great loss can be avoided through the development of preservation of fruits and vegetables by canning and sterilization. Based on costs alone the only commercially feasible methods in preparing substantial quantities of fruit appear to be heat sterilization or dehydration. In the present time there are, in Bangladesh, only a few small scale fruit and vegetable canning plants. They are mainly engaged in producing jam, jelly, chutney, canned pineapple juice, canned pineapple, etc in very limited quantities. Most of these manufactures are located in the suburb of Dacca and Chittagong and are equipped with very limited, manually operated equipment.

This pre - feasibility study has been prepared with an object to utilise the national wealth in the pineapple and vegetable crops and simultaneously in conformation with the discussions of the Government to industrialise the less developed regions of the country. Such an under - developed area is the District of Chittagong Hill Tracts, where large quantities of pineapples are planted and produced. As there are no regular marketing facilities of this product or to process it, the pineapple growers have to face, especially in the time of glut, serious problems. They have been mainly suffering as they are not getting fair prices for their product. As a result some of them hesitate

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to expand the production of pineapples and vegetables. Moreover the situation is further aggravated due to the communication difficulties during monsoon period, when the pineapples are harvested. As the growers are being deprived of fair prices for their products for the last few years, the production of pineapple in the region has considerably declined.

Hence, practically no attempt has been undertaken to improve the quality, increase the productivity and extend the production season of pineapples. The project promoter, Bangladesh Sugar and Food Industries Corporation proposes to establish a fruit and vegetable canning plant in Chittagong Hill Tracts mostly for the above mentioned reasons. Apart from these, there will be new employment opportunities for the people of this region.

Studies and Investigations already performed:

The BSFIC has already worked out:

1. The project profile on Fruits and Vegetable Processing Unit at Chittagong Hill Tracts.
2. Project Proforma (PP) submitted by BSFIC to the Planning Commission on 5th December 1977.
3. The project was included into the First Five Year Plan 1973 - 1978 among proposed projects by the BSFIC.

Conclusions Arrived:

This project was going to be lined up from West German Credit. On 8th July it was decided by the ECNEC, that instead of setting up this project in Public Sector it would be set up in the Private Sector. Accordingly, the relevant papers of this project were handed over to BSRS and BSB for necessary action. After some time it had been stated that in absence of Private Sector the canning plant could be set up on a joint venture basis with 51% share of public Sector. The BSFIC referred to the Ministry of Industries with the suggestic . that the responsibilities of the public Sector could be entrusted to the Chittagong Hill Tracts Development Board and decision from the ECNEC was required. Ministry of Industries was requested to take necessary steps. The ECNEC in its meeting held on 19.3.77 decided that this project would be implemented by BSFIC as a joint venture project with reputed foreign firms for export.

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The BSFIC was in touch with foreign missions in Bangladesh to locate reputed foreign Fruit and Vegetable Canning Firms for jointcollaboration. No satisfactory response had been received.

On 23.8.77, a meeting was held in the chamber of Honarable Adviser and it was decided, that this project would be undertaken by BSFIC and necessary steps should be taken to finance the project out of FRG credit. To pursue the matter a meeting was held on 13.9.77 that was attended by the Secretary, ERD, Planning Commission and others. Another meeting was held in Planning Commission on 20.9.77 to consider the financing of the project out of FRG Project Loan. In that meeting also this project was included in the list for preparing before FRG authorities.

The latest stage of the project:

I have been appointed by UNIDO as an expert for the BSFIC in Bangladesh in Public Sector. In my opinion, this is a priority project and as such this pre-feasibility study has been undertaken after consultation with the officials of BSFIC.

LOCATION AND SITE:

Land Survey: The area in Chittagong Hill Tracts is a hilly land with many bays and islands. It must be said that, in the surrounding of the district town Rangamati, due to the erection of new public buildings, schools etc., in fact there is not much proper space free to set up the plant. The relatively good situated area, previously ear-marked to erect the fruit & vegetable plant, has already taken for another construction in progress.

Within my only one-day stay in Chittagong Hill Tracts a discussion was held and attempts were made to find a spare area to establish canning plant with Deputy Commissioner of Chittagong Hill Tracts, Mr. Ali Haidar.

Tracts coming into consideration for the erection were visited together, but no conclusions were taken, namely, claims of the proprietors should be cleared first. Mr. Haidar promissed the most possible help by his office.

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Area Study: The area for the plant must be considered from some important points of view :

1. As there are no roads to connect adequately the farms with the proposed plant, the main transport of fresh fruit into the factory will be considered by water ways.
2. Simultaneously communication with the main traction Chittagong - Rangamati must be secured for transportation of ready products, packing material and other raw materials, including fuels.
3. Sufficient supply of drinking water must be secured.
4. Easy connection on main electric line.
5. The waste water treatment must be carefully considered. Provided that the plant will be situated on one of the islands or peninsula, an efficient waste water plant must be installed, so that the quality of the lake water would not be detoriorated.
6. Liquidation problem of giveaway products (wastes) must be also solved.

Estimated Costs of the Land:

As there has not yet been exactly decided about the site of the plant, only rough calculation of costs can be estimated.

Acreage demands:

For the errection of the plant a flat good drained site will be needed. The need of acreage will be estimated as follow:

1.	Sorting room and stock of fresh fruit open shed.	480 m^2
2.	Production Hall	340 m^2
3.	Cold store	1,700 m^2
4.	Storage building (90, + 268,-)	360 m^2
5.	Auxiliary buildings	130 m^2
6.	Dressing room, toilets, Lavatories	200 m^2
7.	Waste water treatment	900m^2
8.	Yards	2200 m^2
9.	Roads	1300 m^2
10.	Total	7.610 m^2

Estimated costs per acre(= 4.040 m^2)is 60,000 Taka. ..../

ANALYSIS OF NATURAL RESOURCES:

The pineapples (Ananus Comosus Linn) are among the most esteemed and nutritious of the tropical fruits. It is a stemless perennial plant. Botanically the fruit is a compound one, resulting from a number of flowers. It is borr on an erect, stout stalk in the centre of the plant thrives best in rich loamy soil, which is well drained and light shaded, wherever the annual rainfall is about 50" within the year, with fairly moderate temperatures. In Bangladesh, estimated acreage under pineapple production in 1976-77 was 36,185 acres as against 35,475 acres in 1975-77. The acreage increase has been mainly due to the departmental activities, yield per acre of the crop for 1976-77 stands at 106 mds. One of the most progressive regions for planting pineapples in the last time, by the Government promoted, is Chittagong Hill Tracts.

Agronomical Data:

According to Mr. Saidur Rahman, the Project Director of Horticulture Development Board and Deputy Commissioner of Rangamati, Chittagong Hill Tracts Mr. Haidar there will be this year already total 11.860 acres area planted out with pineapple plants. The total estimated production in 1976-77 was 38,775 tons (long tons). Number of pineapple plants planted on 1 acre : 10,000 plants.

Yield Assessment in the Crop 19,8 per Acre:

According to Horticulture Development Board 30.7.78:

1. Variety Honey Queen 5 L/ton per acre.
   The average weight of 1 fruit : 0.45 kg - 0.90 kg(with crown)
2. Giant Kew - 11.5 L/ton per acre
   The average weight of 1 fruit is 2 Kilo (with crown).

...../

Ground:

Origin: 0 - Sedimentary Rocks -

a) Semi - consolidated fine grained sand stones interbedded with shales and settstones comprising the high hills (tipam and Surma formation).

b) Unconsolidated to semiconsolidate, fine to coarse grained materials comprising usually the more extensive low hillocks (Dupi Tila formations).

Colour:

0 - brown earth - Mainly the soils developed on high hills i.e. on consolidated sedimentary rocks and partly on unconsolidated (Dupi Tila) low hillock soils are shallow.

0 - red earth - Mainly on unconsolidated fine to coarse grained Dupi Tila formations (low hillocks) soils are deep and well drained.

Climatic Conditions:

Meteorological phenomena:

Dew : October - April

Frost : Nil

Snow : Nil

Hail : March to April

The survey about temperature, relative humidity, intensity, hour light are given in the table No.1.

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TABLE-1

Place: Main climatic conditions in the region of Rangamati, Chittagong Hill Tracts.

Dislocation: Altitude on sea = 208 ft. (Height of Bar Listern)

Distance from the sea km 54 Km (Approx.)

Main artery of communication : By road from Chittagong.

	59.0 Temp.min.	80.3 Tem. max.	93 Average relative hum.in 0000 hours.	83 Aver. rel. hum. in 0300 G.M.T.	65 Aver.rel.hum. in 1200 G.M.T.	0.23 Raininess inches	08 no.days of rainness	hours of rainness daily	0.50 Max.in 24 hrs. inches(raininess intensity	06.33 hours light from sun rise to sun set in 3[illegible]	17.07	Luminosity/ intensity
January		85.7	88	71	50	0.53	08		280	06.24	1752	
February	69.8	91.9	86	65	51	1.77	23		270	06.00	1800	
March	76.6	94.8	86	69	61	3.43	43		249	05.31	1812	
April	77.5	94.6	87	71	69	7.35	90		286	05.11	1825	
May	77.4	89.2	91	81	85	25.42	190		1355	05.06	1837	
June	77.6	89.5	92	82	86	26.52	199	Not recorded	9898	15.16	1838	Not recorded
July	77.1	88.9	92	83	86	20.15	21.9		137	05.29	1822	
August	77.9	90.5	91	79	83	11.31	15.7		7.90	05.35	1755	
September	76.0	89.0	91	82	77	7.11	9.5		3.98	05.49	1725	
October	69.7	85.2	92	82	71	1.12	1.8		2.10	06.05	1708	
November	62.8	80.9	93	83	67	0.68	0.4		3.63	06.24	1710	
December												

0) Intensity = N (Normal), M(medium), I(intense)

N.B. : based on data from 1961-70 except sun rise and sun set.

TABLE No. 2

STATEMENT OF DIFFERENT FRUITS PRODUCTION ALONG WITH AREAS OF CHITTAGONG HILL TRACTS IN DIFFERENT YEARS

Name of Fruit	1975 - 76			1976-77		
	Area (in acre)		Production (in mds.)	Area (in acre)		Production (in mds.)
	F.bearing	N.F. bearing		F.bearing	N.F. bearing	
Pineapple	11394	-	1003380	11860	-	1055540
Banana	11175	-	3999021	10970	-	2216170
Cashewnut	3170	-	15850	-	-	-
Guava	215	255	11395	225	265	12005
Jackfruit	1125	910	106875	1115	935	105095
Mango	780	650	47641	840	665	53047
Jam. Sarifa	330	-	8908	315	-	8094
Coconut	130	225	5434	185	235	7585
Jalpai	270	-	6480	250	-	5753
Betel leave	160	-	4800	135	-	3654
Litchi fruit	75	70	2138	90	80	2793
Mandarin	75	120	4067	70	115	3780
Papaya	455	-	19565	495	-	27990
Fer (Kul)	70	50	2100	65	60	1886
Lime and Lemon	230	-	5520	230	-	5520

Source : Office of the District Extension Officer, Rangamati.

Planned Progress in the Agricultural Sphere:

According to the accessible sources, especially by Bangladesh Agricultural Research Institute and papers mentioned in the references, there are three varieties planted in Bangladesh.

1. Honey Queen
2. Giant Kew
3. Red Spanish (Ghorashal).

Of these, Honey Queen and Giant Kew are planted in Chittagong Hill Tracts. Although there are serious shortcomings in planting methods, pineapple is perhaps the most likely fruit prudent for increased production and processing. While in Hawaii, the "Kew Pine" which bears fruits often weighing 12 lbs or more with yellowish flesh the weight of domestic varieties achieves mostly 1 pound with the Honey Queen variety and Giant Kew little more than 1 lbs (with crown). Production and quality of fresh pineapple could be considerably improved and increased by the following measures:

Variety Standardisation:

Production for canning should be confined to Giant Kew which is known in the world trade as "Smooth Cayene". Improved selection of this variety should be utilised in plantings made for canning purposes. Other varieties now grown are less suitable for canning and should not be grown or processed for canning. Mixing varieties leads to drastic reduction in quality of canned products.

Irrigation:

Supplementary irrigation should be introduced to ensure adequate yields and desirable fruit size and shape.

Research in Production and Technology:

Areas requiring intensive research including varieties and clonal selection, fertilization, irrigation, disease, insect and nemotode control. In Bangladesh the harvest period is spread over only in three months, that would considerably limited the utilisation of facilities.

The control of flowening by proper hormone treatment may ensure a year round supply of fresh pineapples, quality control and other aspects of canning technology as in Malaysia, Australia and Hawaii.

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According to the Bangladesh Agricultural Research Institute there had been yet an exhaustive research in pineapples that would be adequate to the importance of pineapple in Bangladesh agronomy.

There should be a co-ordinated effort among the producers of pineapples, Government agencies like Ministry of Agriculture, Agricultural Research, Horticulture Board and proposed processing industry i.e. BSFIC. They should work hand in hand so that production of pineapples and setting up the canning plant will go simultaneously. (See Appendix No.1).

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 both varieties, from each varieties 10 pieces of fruit were presented.

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TABLE No. 3

DIVISION OF FOOD TECHNOLOGY AND NUTRITION

BCSIR LABORATORIES, DACCA

REPORT

No. of Samples : 10

Date of Receipt: 5.7.78

Date of submission of Report: 13.7.78

Particulars of sample: Pineapple(Giant Kew)

Ref.No: PP/73.02/B/1648

Date: 5.7.78

Received from/Refer: Bangladesh Sugar and Food Industries Corporation, Dacca.

	Before Peeling			After Peeling				Acidity				
Sl No.	Initial whg of each (gm)	Height cm	Dia cm	Wt of skin of each (gm)	Height cm	Dia cm	Wt of core of each (gm	Wt of pulp of each (gm)	pH	Calculated as Citric acid %	Soluble solid %	Total solid %
1	612.0	8.77	7.17	229.0	6.87	6.50	31.5	351.5	3.60	0.71	7.40	8.60
2	719.0	10.23	7.64	169.5	8.60	6.20	37.5	512.0	3.55	0.82	7.72	9.57
3	656.0	10.10	7.02	200.0	8.70	6.60	39.0	417.0	3.53	0.90	7.72	8.95
4	601.0	10.61	6.67	217.0	8.90	5.90	39.0	345.0	3.55	0.82	7.09	7.99
5	656.0	8.71	7.60	245.5	6.70	6.50	32.0	378.5	3.55	0.80	6.75	7.89
6	583.0	10.00	7.00	216.0	7.85	6.00	34.5	332.5	3.58	0.80	7.70	8.96
7	673.0	10.00	7.60	220.5	9.00	6.80	41.0	411.5	3.35	0.73	7.00	8.48
8	617.0	9.20	7.80	208.5	8.20	6.10	37.5	371.0	3.55	0.70	6.78	8.35
9	680.0	9.80	7.70	229.0	7.30	6.80	34.0	417.0	3.56	0.64	7.50	9.05
10	645.0	9.90	7.50	204.0	8.26	6.50	36.5	404.5	3.50	0.83	8.00	9.26

Remark/Comment:- The percentages of soluble solids and total solids are low due to immature pineapple.

TABLE No. 4

DIVISION OF FOOD TECHNOLOGY AND NUTRITION

BCSIR LABORATORIES, DACCA

REPORT

No. of samples:- 10

Date of Receipt: 5.7.78

Date of submission of Report: 13.7.78

Particulars of sample: Pineapple (Honey Queen)

Ref.No. PP/7302/3/1648

Date: 5.7.78

Received from/Referred:

Bangladesh Sugar and Food Industries Corporation, Dacca

	Before Peeling			After Peeling				Acidity				
Sl No.	Initial wt of each (gm)	Height cm	Dia	Wt of skin of each (gm)	Height cm	Dia cm	Wt of core of each (gm	Wt of pulpof each (gm)	pH	Calculated as citric acid %	Soluble solid %	Total solid %
1	567.0	10.09	6.60	123.0	8.37	5.16	43.0	40.10	3.85	0.58	15.72	18.73
2	652.0	11.59	6.23	257.0	10.30	4.80	44.0	351.0	3.89	0.71	14.10	15.19
3	427.0	8.92	5.92	158.0	7.27	4.94	43.0	226.0	3.80	0.87	14.00	15.10
4	419.00	8.99	5.75	161.0	7 56	4.02	35.0	223.0	3.76	0.75	14.30	16.67
5	653.0	11.50	6.62	247.0	9.53	5.44	43.0	363.0	3.75	0.84	15.65	16 67
6	556.0	9.80	6.63	248.0	8.10	5.04	38.5	269.5	3.70	0.82	15.16	16.55
7	474.0	9.18	6.00	207.0	7.60	4.66	35.5	231.5	3.75	0.81	14.70	16.75
8	416.0	9.90	5.40	170.0	7.97	4.60	37.0	209.0	3.57	0.89	14.15	15.01
9	450.0	8.50	6.50	202.0	6.33	5.30	31.0	217.0	3.80	0.50	16.40	19.06
10	439.0	9.60	5.70	176.0	7.50	4.80	35.0	228.0	3.65	0.65	15.80	16.82

FRUIT OCCURENCE DIAGRAM WITHIN THE YEAR IN CHITTAGONG HILL TRACTS:

TIME TABLE

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
PINEAPPLE HONEY QUEEN					●———	———						
PINEAPPLE G. KEW						———	———					
BANANA	———	———	———	———	———	———	———	———	———	———	———	———
PAPAYA	———	———	———	———	———	———	———	———	———	———	———	———

SOURCE: 1. "A study report on Fruit and Vegetable Processing"
Dr. Sheikh, 1977.

2. Agriculture Development Board, Rangamati.

EXPLANATION: Full line = piek season

STROKED LINE: The begin and end of the season.

HARVEST DIAGRAMS ACCORDING TO VARIETIES:

HARVEST DIAGRAM NO. 1

HONEY QUEEN VARIETY - CHITTAGONG HILL TRACTS:

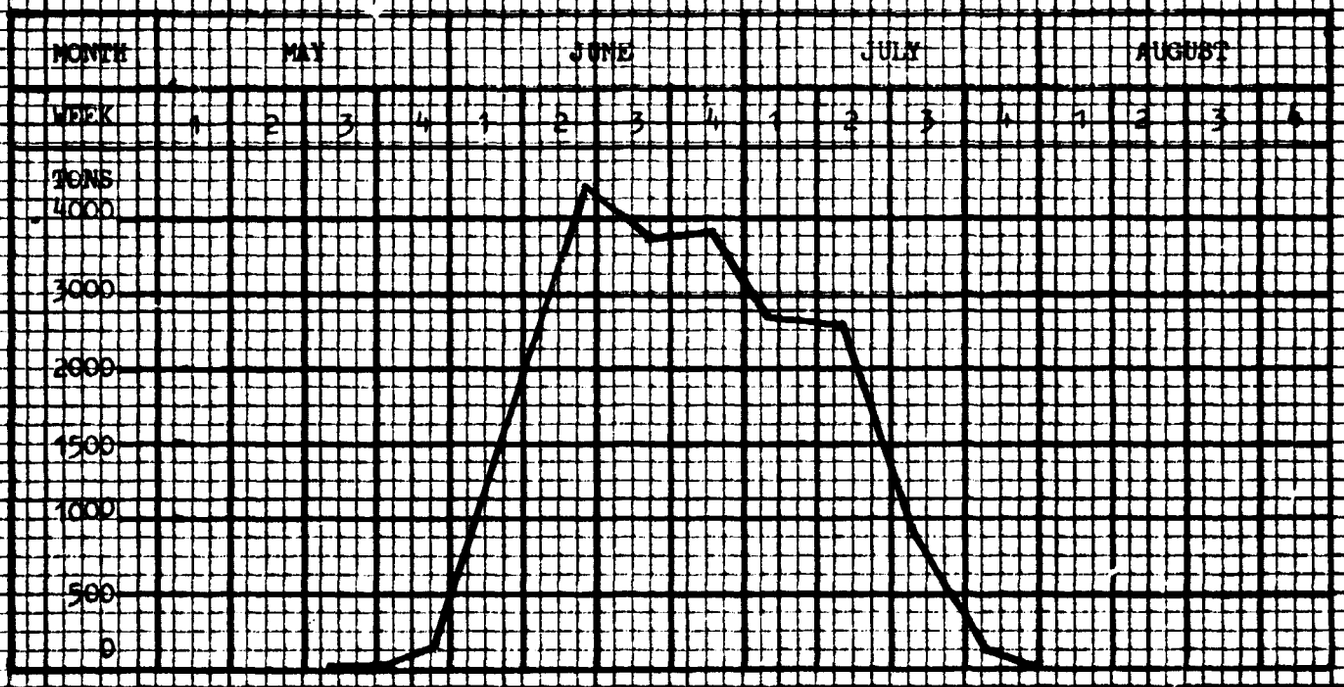


DIAGRAM NO 2

GIANT KEW VARIETY - CHITTAGONG HILL TRACTS

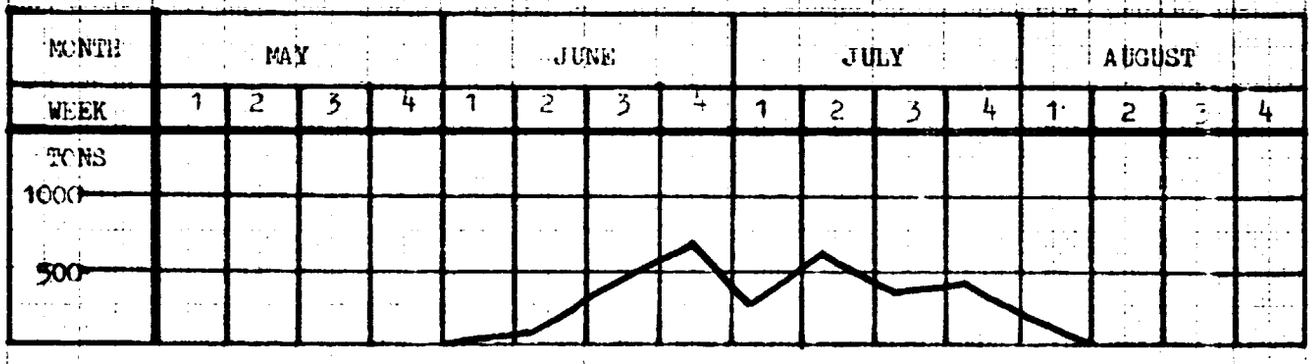
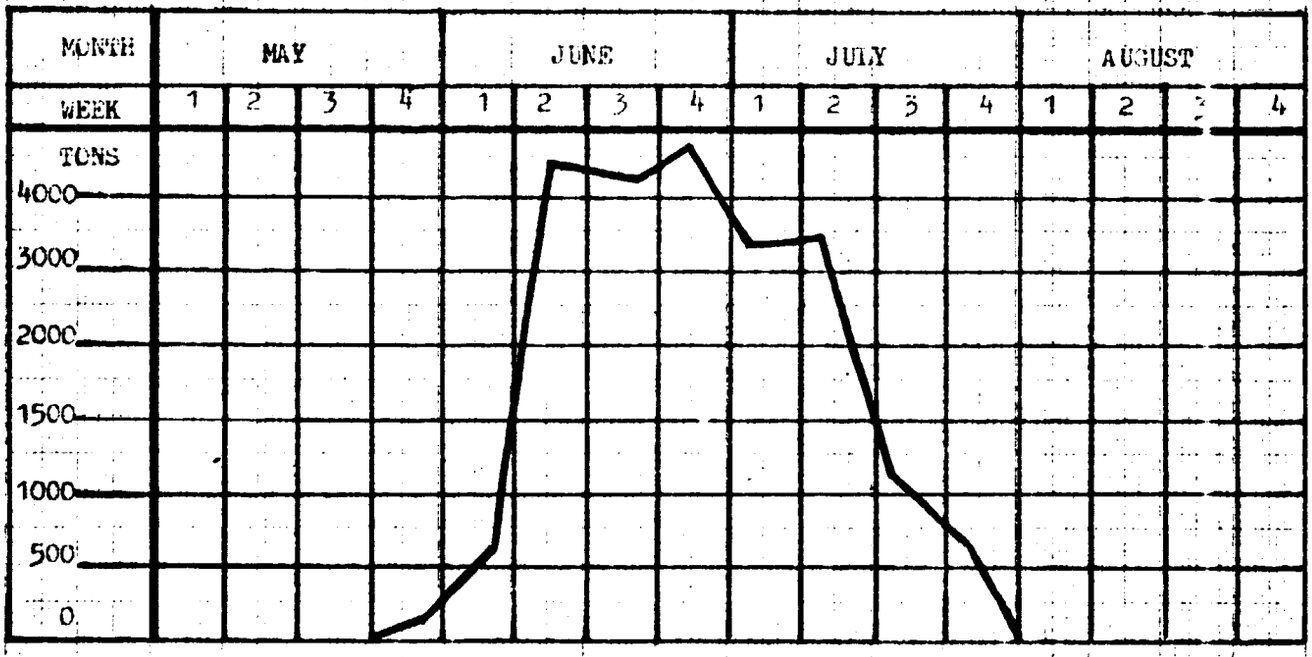


DIAGRAM NO. 3

PINEAPPLE HARVEST BOTH VARIETIES:



It is calculated, that after 2 - 3 years the further development in planting will favourably influence the yield of crop and both the quantity of fruit, so that the production period will be possible to extend for more than three months.

To cover the fresh pineapple demand in August and in that way to prolong the production period, the 1000 ton cold store is projected. Further production extension will be ensured as mentioned above, by agrochemical arrangements only.

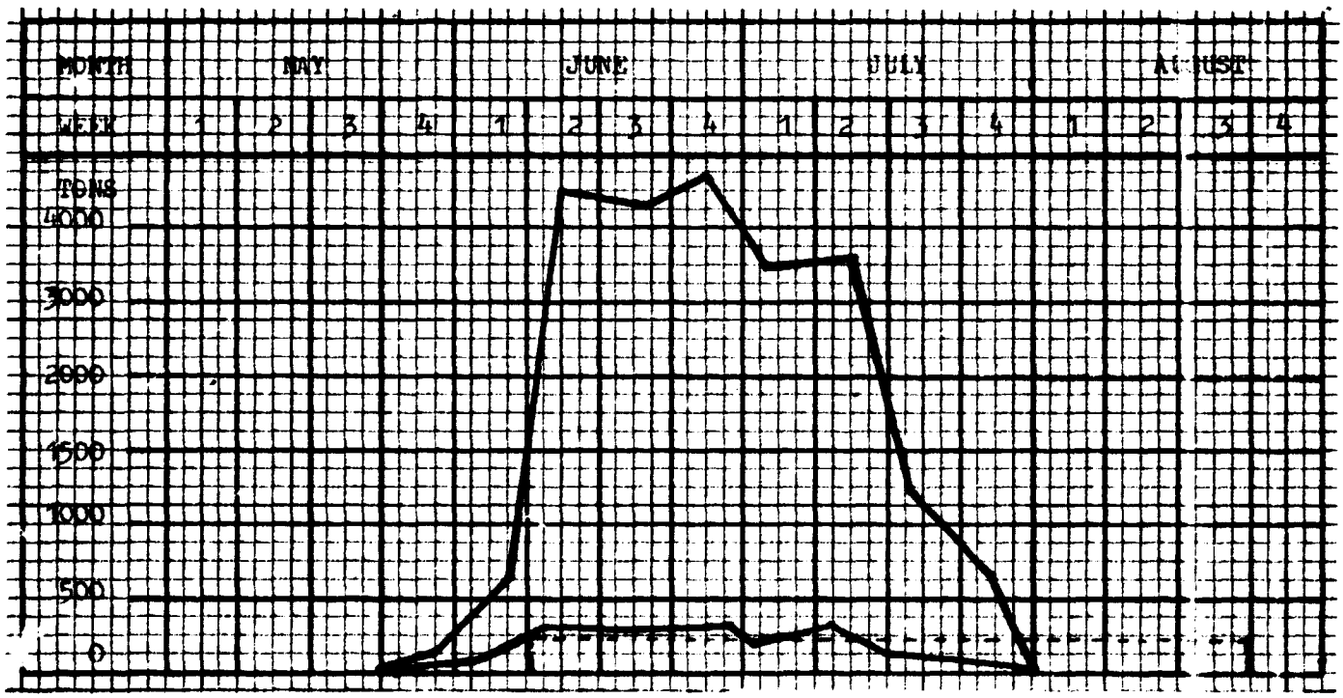
FRESH FRUIT CONSUMPTION PER ONE HOUR:

Parallel production :	Sliced pineapple fresh fruit	1.770 kg
	Jam	399 kg
	Juice concentrated	3.190 kg
	Total consumption :	5.359 kg pineapple

Consumption per 1 shift 5.359 x 7% = 40.193 kg pineapples
Consumption per 7 days 40.193 x 7 = 281.351 kg pineapples

DIAGRAM NO. 4

PINEAPPLE BOTH VARIETIES:



EXPLANATION : Full line: Pineapple production in the region Ch.H.T.
Red line : Supply position in Rangamati assembly market.
Yellow line: Consumption of fruit in the projected plant

DATA : A study report, Dr. Sheikh, Dec. 1977

Technological Feasibility of the Fruit:

Description of Fruit Development:

The pineapple is, in general, cultivated by vegetative reproduction. In Hawaii, the planting season is in the autumn and the first fruit is harvested between 18-22 months later. Each plant produces one fruit. The first fruit is called plant crop fruit. Approximately 12 months later a second crop is harvested. The later fruit is usually smaller than plant crop fruit.

Anatomy of Fruit:

The pineapple is a composite or collective fruit. It is a collection of small fruits, called fruitlets. In ancestral species each fruitlet was borne separately on the fruit stem. As a result of evolutionary process, the individual fruitlets become fused, this forming a composite fruit. The edible flesh of the fruit is comprised mainly of ovaries and the bases of sepals and brats. The white pattern that is obvious in slices of many varieties is due to the nectary gland. From the technological point of view it is necessary, that the flesh of pineapple that should be processed in slices has a compact texture without holes and rests of peels, that sometimes, especially with deteriorated varieties, penetrate deep into the flesh pulp and make such fruit improper for processing into the quality products. Very important is the proper maturity of fruit. There are four distinct stages in pineapple fruit development.

1. Development: The period from the end of processing to and including the ripening of the fruit.
2. Pre-maturation: The period of fruit development after the completion of preparing upto 7 weeks prior to half - yellow shell.
3. Maturation: The 6 or 7 week period prior to half-yellow shell.
4. Ripening: The final 2 or 3 week period of maturation.
5. Senesence: The period following the ripening of the fruit.

Onset of maturation is charactarised by an accelerated decline in shell pH. The respiratory rate and the nonprotein nitrogen in flesh cease their marked decline. Flesh brix and titrable acid begin a marked increase.

Flesh carotenoid pigments level off.

The start of ripening is indicated when there is a rapid loss of shell chlorophyll, the flesh pH reaches a minimum and begins to rise; the respiratory rate starts a slow rise after having reached a minimum; volatile esters accumulate rapidly. NPN and sugars in the flesh begin to increase; shell brix increases; flesh pigments increase rapidly, while shell pigments decline; titrable acid reaches a peak and begins to decline.

...../

Chemical indicators reveal when the fruit passes from ripening to senesence; shell pH and NPN begin to rise, chlorophyll is completely gone. Flesh brix and pigment increase. Although texture is not considered a major quality problem in fresh pineapple a situation arise in canning operation that resulted a major investigation of cell wall components. Cell wall composition of pineapple fruit flesh at different stages of development are shown in the table.

TABLE NO. 5

Cellwallcomposition of pineapple fruit flesh at different stages of development.

Analysis	Days from ripeness					
	-103	-16	-26	-7	0	+7
Fruit (fresh weight)						
Moisture	91.9	92.3	91.9	84.5	83.9	82.5
Alcohol insoluble (%)	3.22	2.46	1.36	1.58	1.55	1.64
Alcohol insoluble (air dry)						
Moisture (%)	7.96	7.36	6.89	6.35	5.70	5.30
Ash (%)	5.37	4.69	3.19	2.24	2.30	2.83
Protein (N_2 x 6.25) (%)	13.0	10.6	8.6	9.3	9.5	10.5
Fibre (corrected for protein) (%)	52.4	58.4	59.8	59.0	56.6	55.2
Anhydrouronic acid (%)	7.23	6.19	5.78	5.43	5.17	4.22
Unaccounted for (%)	119.1	12.8	15.7	17.7	20.7	21.9

Extracted from numerous Pineapple Research Institute Publications.

Fibre appeared to reach a maximum at the onset of ripening and then decreased steadily through senescence. When comparing samples of normal and fragile fruit of equivalent ripeness it has been accertained, that the fragile fruit contained less fibre and more pectin and hemicellulose than the normal fruit. The most difference had been formed in higher degree of esterification of pectin in normal fruit than in fragile fruit. It is supposed, that the problem of fragile pineapple could be atributed to a decrease in fibre and increase in total pectin and hemicellusose and less in esterification of pectin.

...../

TABLE NO. 6

A comparison of cell wall characteristics of normal and fragile pineapple:

Analysis	Normal	Fragile
Marc (% of fresh weight)	1.52	1.79
Analysis of marcs		
Moisture (%)	6.71	7.79
Ash (corrected for CO_3-) (%)	2.83	3.18
Protein (%)	10.2	10.8
Fibre (%)	62.9	56.7
Anhydrouronic acid (Titration) (%)	5.51	7.48
Anhydrouronic acid (colorimetric) (%)	5.60	6.16
Unaccounted for (%)	11.8	15.4
Free acid (meq/g)	0.18	0.37
Total esters (meq/g)	0.76	0.59
Acetyl (meq/g)	0.63	0.54
Exterification (%)	42.4	6.16

Acids: There are two major acids in pineapple: citric and acetic. Although ascorbic acid does not contribute substantially to fruit acidity, it would be noted that there is, apparently, a positive correlation between levels of ascorbic acid in pineapple fruit and the amount of solar radiation to which the plant and fruit are exposed.

Nitrogen: The major nitrogenous and enzyme constituents in pineapple vary with the stage of fruit development. Methionine was present in very low amounts until ripening began; in the ripe fruit it is one of the major animo acids.

The basic animo acids lysine, proline, histidine and arginine are present at relatively lower levels throughout the entire period of fruit development. Protease activity (bromelin) has been shown to very low in fruit just after processing was complete but within two weeks it rose to a high level, but by oneset of ripening there was a marked decline in activity. Bromelin is indicated by Md. Yar Khan, Ph.D., as a digestive ferment.

...../

Post - Harvest Physiology: With stored pineapples chemical changes arise in the fruit. The changes in stored fruit with comparison to fruit left on the plant for an equivalent time shows:

TABLE NO. 7

Comparison of chemical changes in stored pineapple with chemical changes to fruit left on the plant for an equivalent time.

Sample	Shell colour	Esters as ethylacetate (p.p.m.)	Pigment as carotene (p.p.m.)	Ascorbic Acid (mg/100ml	Brix (%)	Titratable acid as citric (% w/v)
Original	2.00	4.2	0.98	12.4	16.8	1.02
Stored						
2 days	2.70	8.0	1.00	12.0	16.7	0.92
4 days	3.81	11.2	1.12	12.5	16.1	0.93
7 days	5.00	16.6	1.18	13.3	16.6	1.03
10 days	5.00	31.6	1.46	13.0	15.7	0.95
On the plant						
2 days	2.64	8.8	1.06	13.8	16.4	0.85
4 days	3.47	7.0	1.27	11.9	17.3	0.85
7 days	4.74	13.6	1.39	11.3	17.5	0.81
10 days	4.92	53.6	1.73	9.1	17.4	0.67

Sensery evaluation indicates that the flavour of stored fruit is not the same as fruit ripened on the plant. It is concluded from these data that the normal ripening process in pineapple fruit ripened on the plant does not take place in fruit harvested at the onset of ripening.

...../

Effect of storage temperature on shell colour and acidity and Brix levels in the flesh

The dependence of time and temperature on the changes of the quality of fruit shows :

TABLE NO. 8

Effect of storage temperature on quality of fresh pineapple.

	Days	7°C	13°C	18.5°C	24°C	29.5°C	35°C
Shell colour	0	1	1	1	1	1	1
(% of area yellow)	5	2	2	8	57	27	32
	15	4	11	82	98	98	88
	8	2	6	34	80	67	59
Acidity	0	0.68	0.68	0.68	0.68	0.68	0.68
(% calculated on original fresh weight)	5	0.89	0.77	0.75	0.70	0.53	0.44
	8	0.81	0.76	0.78	0.77	0.54	0.36
	15	0.78	0.85	0.90	0.67	0.46	0.32
Brix	0	14.5	14.5	14.5	14.5	14.5	14.5
	5	14.4	14.5	13.3	12.6	12.8	12.6
	8	12.8	14.0	13.4	13.7	13.0	12.7
	15	13.0	13.2	13.0	12.3	12.0	10.7

...../

The decrease in brix shows the influence of respiration process, by which parts of monosacharides converts into carbondioxide and heat.

The table shows the dependence of brix decrease on the stored temperature, that should be lower than 13°C, but higher than 7°C to avoid detorioration and to the so called chill injury when stored at temperatures less than 7°C. Mature green fruit are very susceptible to chill injury when stored at temperatures less than 10°C as reported similar observations for pineapple grown in Guinea and Kew variety grown in India.

It has been the experience of workers at the Pineapple Research Institute of Hawii, that for each 6°C decrease in storage temperature for fruit showing approximately 25% shell yellowing at harvest, approximately one week additional storage life may be gained.

At 7°C the maximum life storage was about four weeks.

All the objectivities mentioned in this chapter should serve to solve tasks what matters Anatomy of pineapple.

Maturity and ripening of fruit, chemical indicators.

...../

1. For further development research is necessary to improve generally the quality of fresh pineapples and to extend the period of harvest in Bangladesh. What matters is the quality of texture of the flesh and chemical changes within storing.

2. To project the most feasible technology on processing of ready products, storage conditions including storage of pineapple under lower temperature.

3. To project feasible material handling and storing of fresh fruit and ready products.

Water Supply:

As there is no municipal water supply, own source of sufficient quantity of water must be secured.

The consumption of water is for 9 litre per sec. estimated. (see chapter 8). The quantity of water must correspond to the WHO standards for drinking water.

The hardness of water should not exceed 8 deg (German), otherwise de - hardening unit must be projected.

To consider the quality of water available from bored wells in this region, water analysis from Bonarupa Rangamati is attached.

Of course, definite means of treatment should be taken after trial bores.

In any way great attention to the quality of water must be paid, as the products from this plant are supposed for the export.

...../

TABLE NO. 9

WATER ANALYSIS BONARUPA - RANGAMATI

GROUND WATER SAMPLE

Directorate of Public Health Engineering
Ground Water Programme
Water Sample.

ANALYSIS SHEET

Sample _____ Bottle No. _____ Laboratory Sample Code _____
Date sampled : _____ Time sampled: _____
Contractor: _____ Sampled by : _____
Test Requested Chemical Report Requested by : A. E., BADC(C), Ctg.
Location
District Council _____ P.S. _____ Town _____
Site location -- Bonorupa
Description of Sample:
Depth Sample taken : _____ feet, depth of River is _____ feet.
Water level : _____
Specific location where sample taken : _____

Field Tests:

Temperature _____ C.odor _____. Color _____
Field E.C. _____ pH _____ Chloride _____ mg/1.
Iron _____ mg/1. P.Alkalinity _____ mg/1. T.Hardness _____ mg/1.
Manganese _____ mg/1. T.Alkanity _____ mg/1.

Laboratory Analysis:

Date received Dacca: _____ Date Received Chittagong : 29.3.77
Color Less Odor Less Teste Less Temperature 92 of
PH 6.6 Turbidity in units 25 E.C. m150
P.Alkalinity as CaCO3 0.0 mg/1. Total/Filtrable Residue 80.0 mg/1
T.Alkalinity as " 62.0 mg/1 Silica as Sio2 _____ mg/1
T. Hardness " " 54.0 mg/1 Total Manganese - mg/1
Ca.Hardness " " 26.0 mg/1 Fluoride _____ mg/1
Total Iron 1.4 mg/1 Boron _____ mg/1

RESULT OF ANALYSIS

Cations	mg/1	Factor	me/	Anions	mg/1	Factor	me/
Ca++		0.04990		HCO3	-	0.01639	
Mg++		0.08226		CO3	-	0.03333	
Al+++		0.1112		OH	-	0.05880	
Na+		0.04350		SO4--	-	0.02083	
K+		0.02557		Cl-	1.0	0.02821	
				NO3-	-	0.01613	
				NO2	-	0.02174	
Total :							

Notes and Comments: Satisfactory for human consumption.

Analyst : Sd/-
Date completed: 30.3.77

Reviewed by : Sd/-
Date reviewed: 30.3.77

Junior Chemist
Water Pollution Control Project
DPHC - Chittagong

Production Programme Extension Possibilities in the Future:

The major production programme also in the future should be in increasing production capacity hand in hand with extension programme in planting of pineapples and perallel intensive research in improvement of the technological feasibility of fruit and extension of harvest season. The production capacity of the canning plant correspond (see also harvest diagram) today's supply of fruit and was fixed by the Project Profile and PP in 1977.

There is no doubt that the projected capacity doesn't allow to utilise the up-to-date technology in a 20 ton per hour input plant that means 40 tons fresh fruit per hour, where there are maximum canning operation mechanised. That would be a minimum size for efficient utilisation. But there is no, in present time, adequate supply of fresh fruit to built up such a plant that would be approximately 2.5 million dollar worth of machinery equipment alone. The projected plant is supposed to set up the processing of ready products from pineapple on technological basis that would secure semi-continual production corresponding to the international quality standards to make the products competitive on international markets. It may be presumed, that in future, after the essential planting tasks in pineapples will be developed into the planned dimensions, further production plants with higher production capacity and on higher technical level will be set up as it was already stated in studies by local and foreign specialists (see e.g. study of Perishable Food Marketing East Pakistan - Pages 28,59,60,61,66,67,189: Sharp Gravens Research - 1969).

The soils and climate of Bangladesh are well suited to growing a rather wide variety of both tropical and temperate zone vegetables and fruits. There are real prospects to expand step by step especially in the region Chittagong Hill Tracts and Sylhet the pineapple production and processing of ready products in such extent as in Malaysia or Taiwan, where the pineapple products became an important export article. It can be stated that the same conditions to set up pineapple processing industry exists in this country. The canned products from pineapple, mainly sliced pineapple and juice are in a great demand on the world markets. The export of canned pineapple and vegetable may become an important contribution how to convert local raw material sources and man power into export products in order to strengthen the national economy.

...../

VII. TECHNOLOGY:

The production capacity of the projected plant for single products was adopted to that, that was already approved in PP and other documents, mentioned in the initial chapters of this study. A comprehensive investigation had been the demand to distribute the required production capacity into three shifts operation submitted. But it had been turned out, that for such desired production capacity mainly:

0.5 ton/hour of sliced pineapple;
0.18 ton/hour of concentrated juice and
0.12 ton/hour of jam - marmalade.

there would be really hardly a supplier of relevant machinery equipment to be found, as nowadays, the concerned food industry disposes with much higher production capacities, (FMC, California, USA, offers 20 t/hour capacity of sliced pineapple as minimum size for efficient utilization of the fresh fruits) following the reality that only mass production can result competetive market prices.

In confrontation with this facts it is to be stated, that the projected unit may be considered as a pilot plant, where there some operations are supposed to be performed manually e.g. peeling of pineapple and other fruits. Peeling fruits manually, of course, represents the greatest portion of man power calculated with single production lines.

Generally, for the projected plant three production lines are projected :

1. Sliced pineapple in syrup production line with the capacity ... ... 12 tons/8 hours.

2. Jam and Marmalade production line with the capacity .. .. 3.0 tons/8 hours.

3. Pineapple concentrate juice production line with the capacity ... ... 2.84 tons/8 hours.

..../

The line No.1 : The assembly composition of single production lines has been designed in this study as highly versatile so that the line 1 will be possible to run for the production of cubed pineapple in syrup sterilised, fruit desert in syrup sterilised with the same production capacity.

The line No 2: is provided for 2 varieties of jam: sterilised jam and regular jam. It will be possible to utilize the line for the production of fruit and tomato puree in future.

The line No.3: This line is possible to run also for the production of natural juice, that is still in great demand on the world markets for its incomprorable taste and flavour. To meet all this quality demands, the line is projected as "hot filling" line that will ensure the production of high quality juice. As mentioned above "mixed fruits" fruit desert (position No. d in PP) will be, inspite of the fact that some operations will be performed manually, the technical conception ensures production of high quality products under the presumption, that proper technological treatments and formulas will be followed.

...../

WORKING TIME:

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

1 shift = 8 hours working time = 480 minutes
less ½ hour for making up 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.

TABLE NO.10

TIME TABLE(1978):

MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT	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 PRODUCT TIME-HOURS	195	165	202	180	187.5	195	187.5	202	165	180	172.5	172

...../

PRODUCTION SCHEDULE:

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

Ready Product	Production capacity per 1 hour/ tons	Production in tons		
		1 shift = 7 hours	1 week = 7 days	Whole season = 10 weeks
Sliced pineapple in syrup	1.5	11.25	78.75	788.--
Jam (marmalade)	0.375	2.81	19.67	197.--
Concentrated juice	0.355	2.66	18.62	186.--
Total production	-	16.72	117.04	1,171.--

This production schedule has been worked out on the basis of prolonged production period by means of cold storing - see diagram No. 3.

Remarks:
1. Sliced pineapple juice is the representative of the production line No.1. Instead of sliced pineapple cubed pineapple or fruit desert can be processed.
2. Instead of jam, marmalade can be processed.
3. Instead of concentrated juice a natural juice can be processed.

To approach closer the projected technology, and project at all,

1. Production Scheme
2. Production Standards
3. Quality Standards
4. Man power demand
5. List of machinery equipment

has been proposed and shown in the following pages:

..../

1. PRODUCTION SCHEME NO. 1 - 6

2. SUPPLEMENTARY PRODUCTION SCHEME NO.7 - 10

Explanatory note:

Red marked operations : are performed by machines or device.

Yellow marked operations : Storage operations.

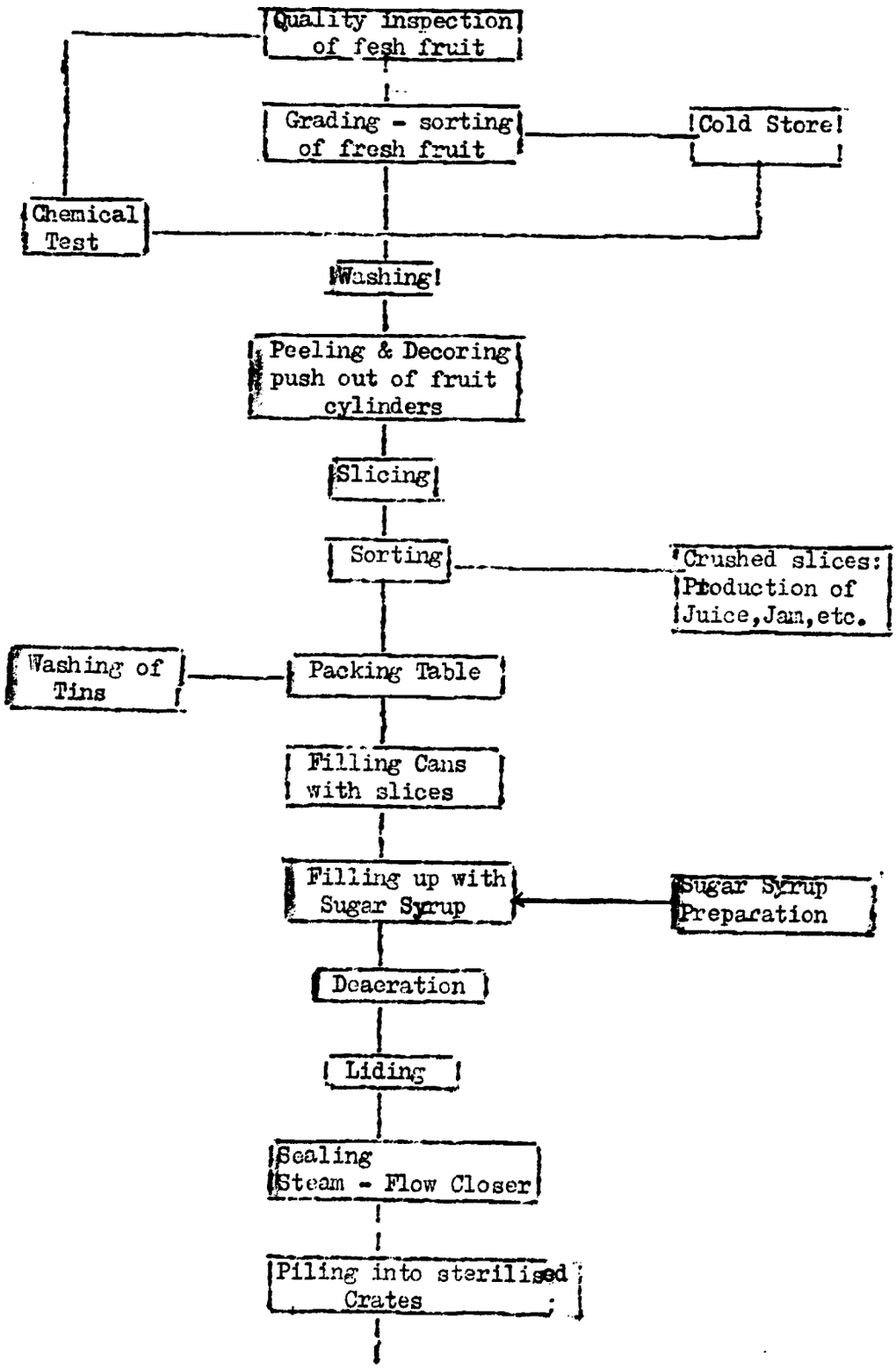
Plain marked operations: Manually performed.

Production Scheme No.1

Sliced Pineapple in Syrup Sterilised

Production Capacity: 1.764 Pcs Tins 99 x 118MM/Hour

1 Piece: 2 Sec.



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Production Scheme No. 2

Cubed Pineapple in syrup sterilised

Production Capacity : 1764 Pcs of tins 99/118mm/hour
1 tin = 2 sec.

Production scheme is identical with the scheme No.1. Except slicing the pineapple, the pineapple will be cut into cubes by dicer.

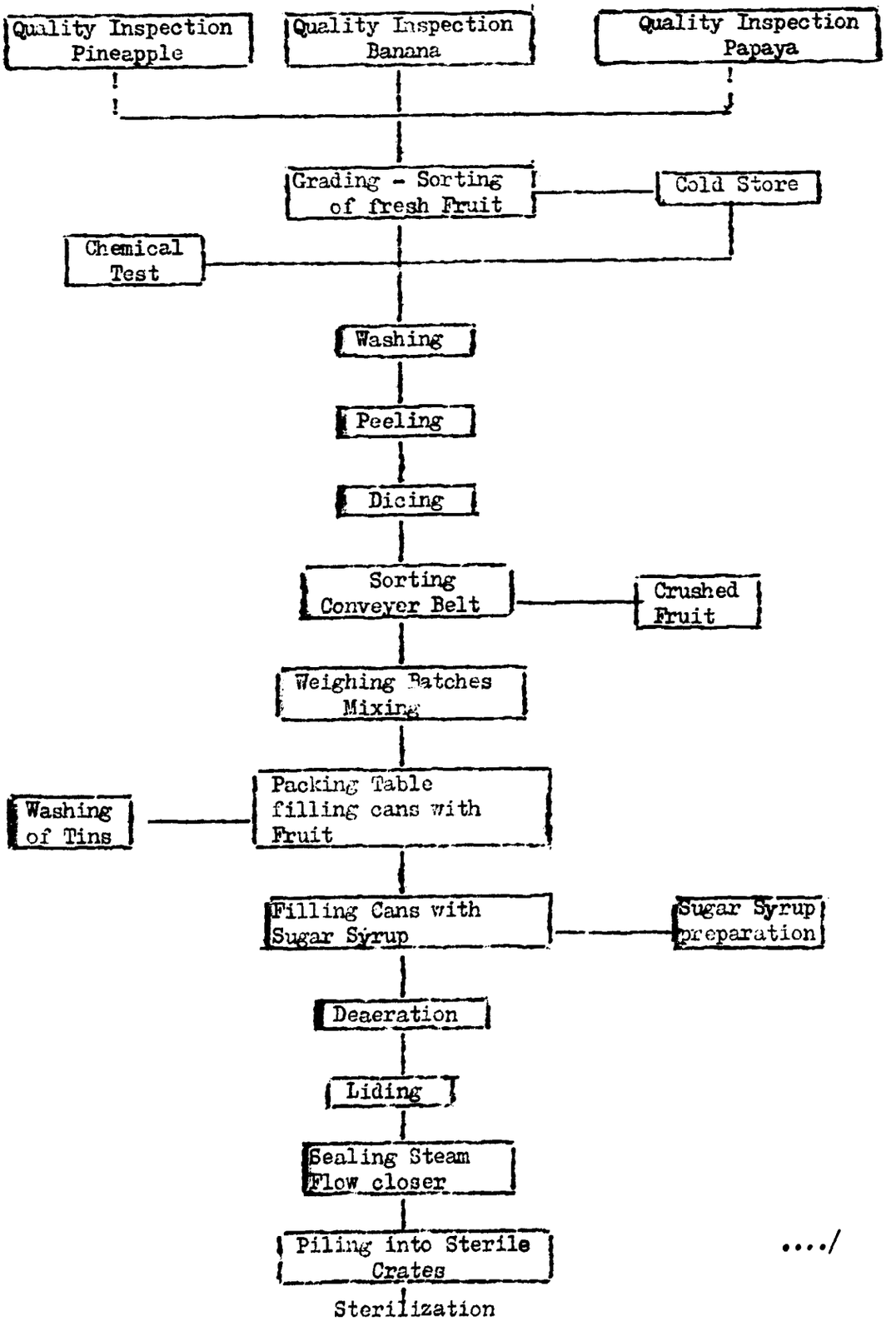
Dicing

PRODUCTION SCHEME NO.3

FRUIT DESERT IN SYRUP STERILIZED

PRODUCTION CAPACITY: 1764 TINS 99 x 118 man/hour

1 TIN = 2 SEC.



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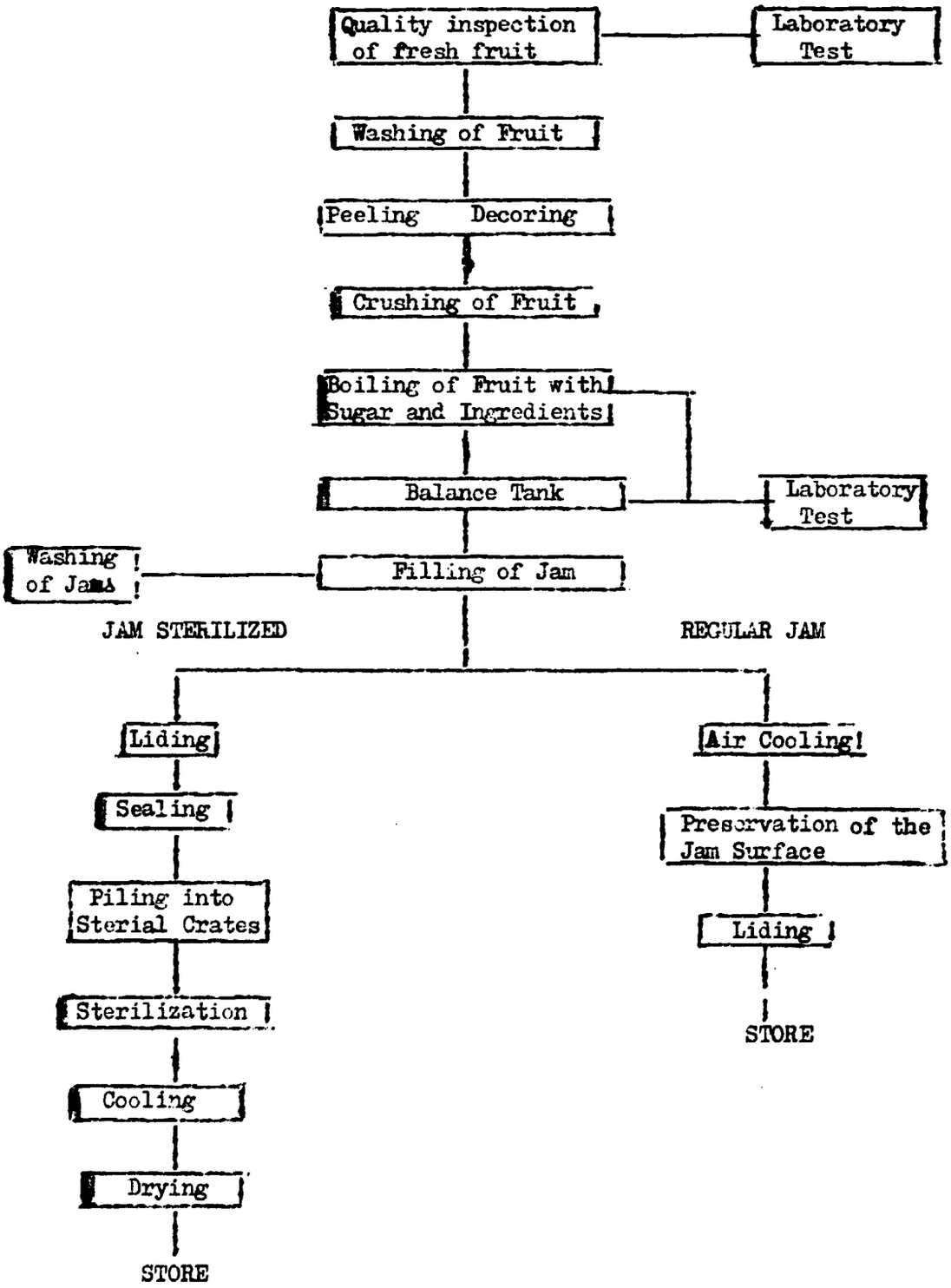
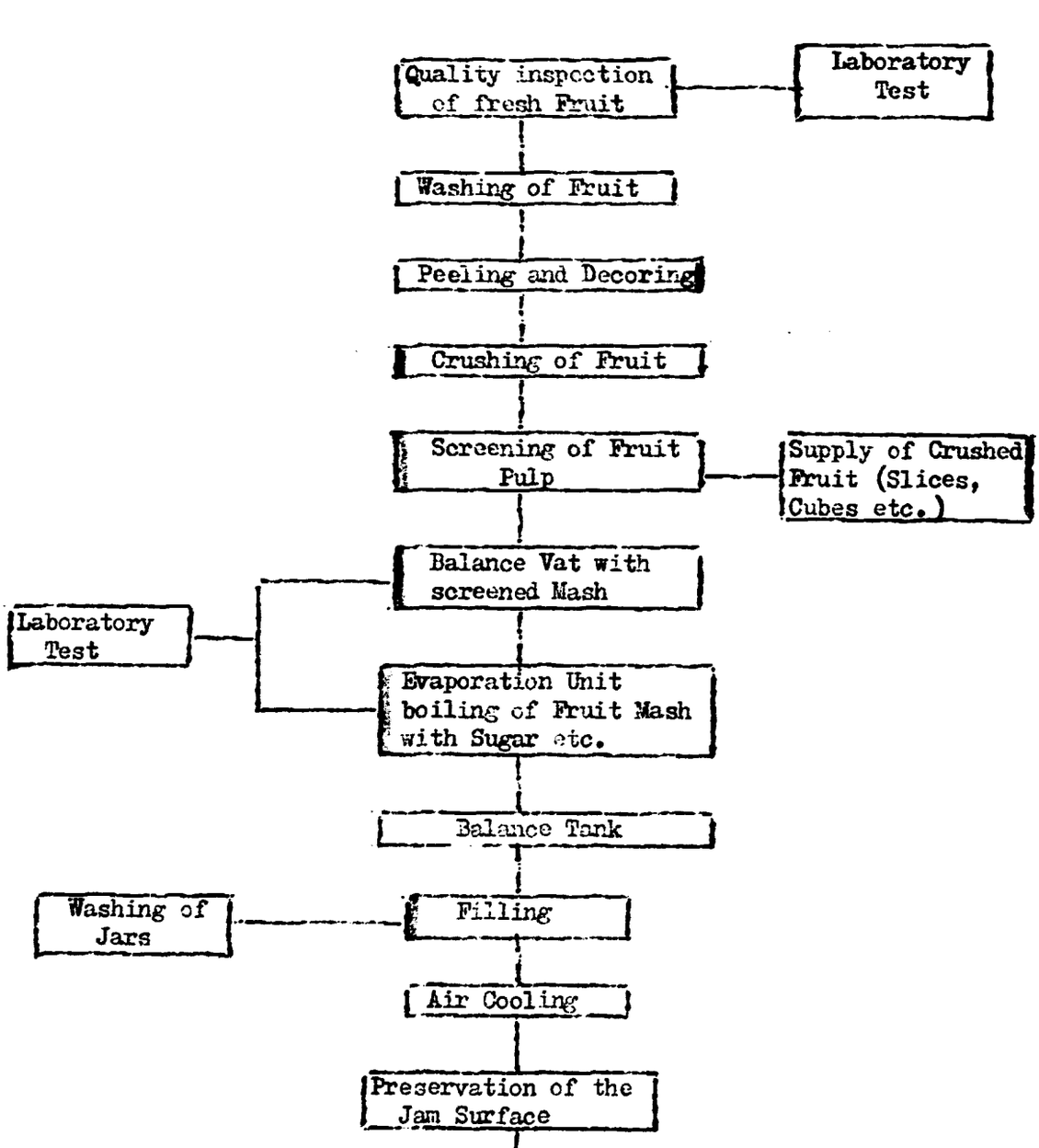
PRODUCTION SCHEME NC. 4

1. PINEAPPLE JAM STERILIZED : CAPACITY 375 Kg/HOUR
2. PINEAPPLE JAM REGULAR QUALITY



PRODUCTION SCHEME NO.5

PINEAPPLE MARMALADE - CAPACITY 375 Kg/Hour.



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COMPARISON OF STERILIZED AND REGULAR JAM

1. Advantages of sterilized jam:

The nutritive value is higher because of higher content of fruit.

The taste is more palatable.

When sealed, the shelf life is longer

Less consumption of sugar.

No extra space for cooling filled jars necessary.

2. Disadvantages of jam sterilized:

Airproof lid and jar for sterilized products are necessary.

Higher consumption of vapour due sterilization. When the jar is open, the juice should be quicklyconsumed or kept in the Refrigerator.

3. Main advantage of regular jam:

The juice is preserved by the high content of sugar

No air proof lid and sterilization is necessary.

4. Disadvantages of regular jam:

Higher consumption of sugar.

Special space for cooling of filled jars necessary.

Risk of the breeding of osmoril yeasts in the surface or inside the jar.

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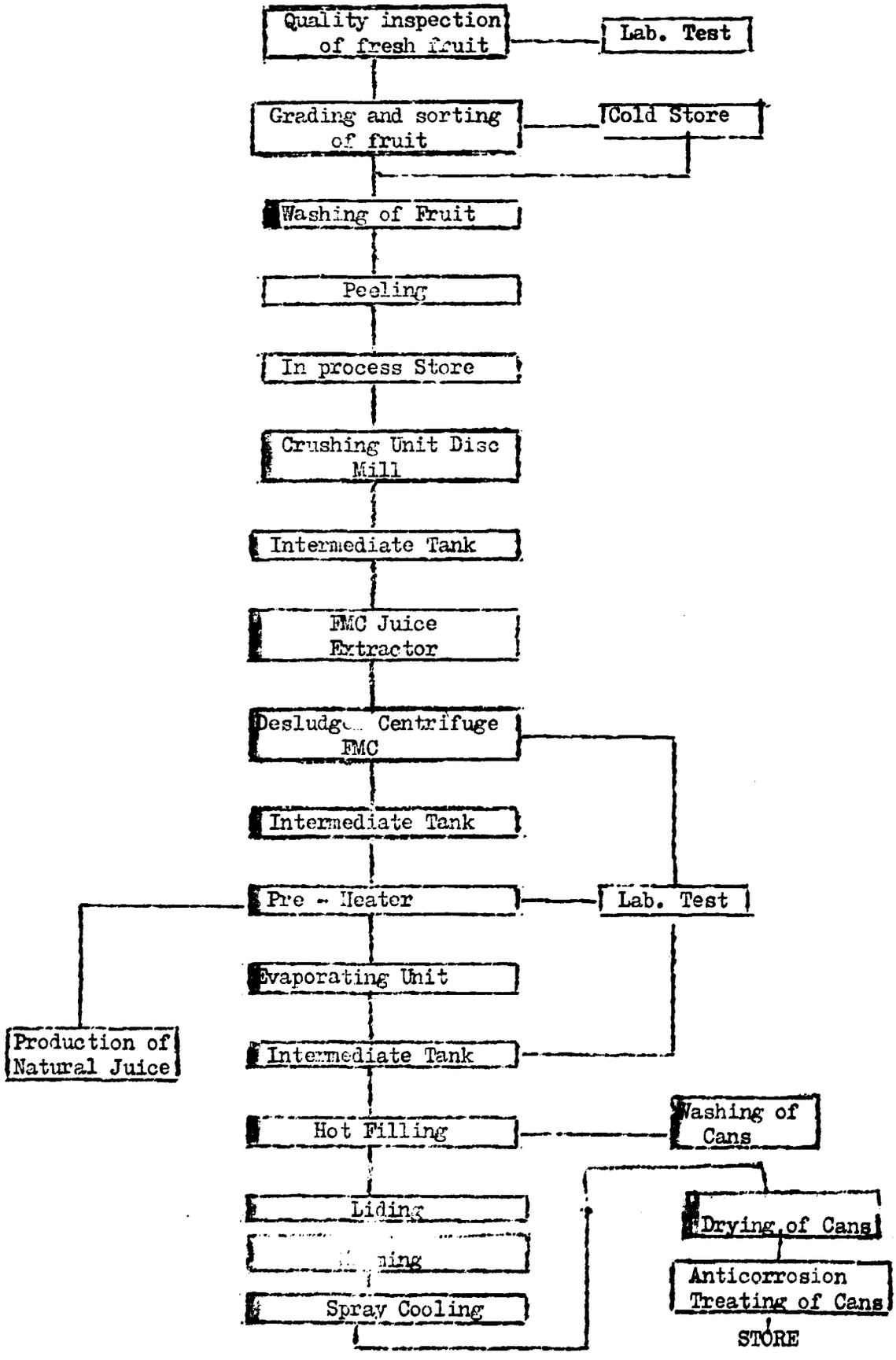
PRODUCTION SCHEME NO.6

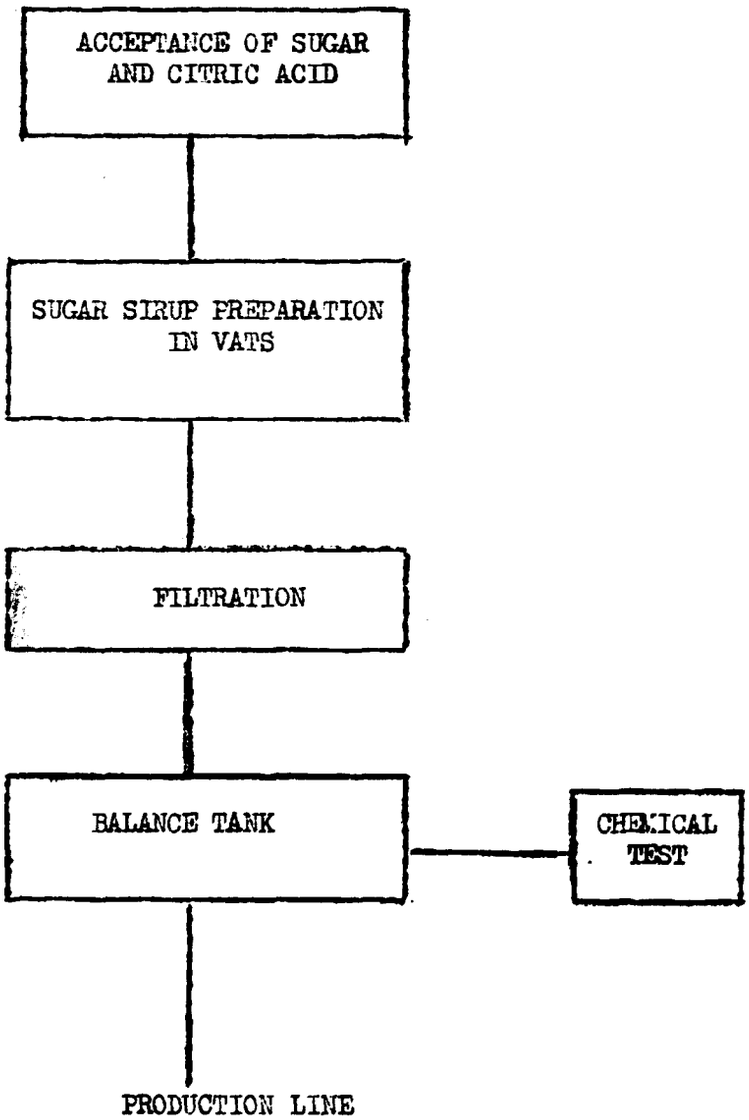
Pineapple Juice : a) Natural 3.300 Tins/H

b) Concentrated 783 Tins/H.



SUPPLEMENTARY PRODUCTION SCHEME NO.7

SUGAR SYPUR PREPARATION



PRODUCTION OF MARMALADE

The projected production line is multipurpose line and except pineapple marmalade can produce another sorts of marmalade and fruit and vegetable juice.

The capacity of this line can be extended, that means redoubled or threefolded with 2nd and 3rd shift.

Planned production capacity is 375,0 kilos of marmalade per hour.

The projected capacity satisfactorily covers the planned capacity.

For the production of juices and marmalade only one shape and capacity of jar is projected.

Content nett 453 grammes = 1 lb.

Provided with OMNIA NECK diameter 68 mm.

The lids are proposed uniform for all ready products filled into the Jars in this plant:

OMNIA aluminium lid ⌀ 68 mm (England)

that is very simple and reliable to operate with minimum losses. Also the sealing machine is most simple, cheap and reliable.

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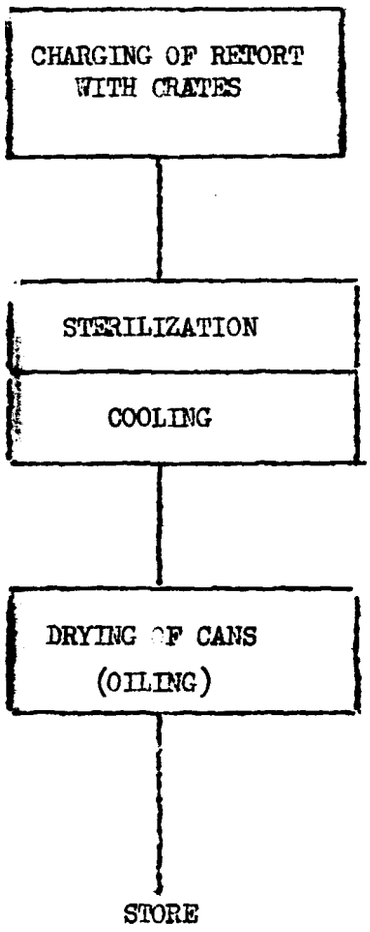
SUPPLEMENTARY PRODUCTION SCHEME NO. 8

STERILIZATION



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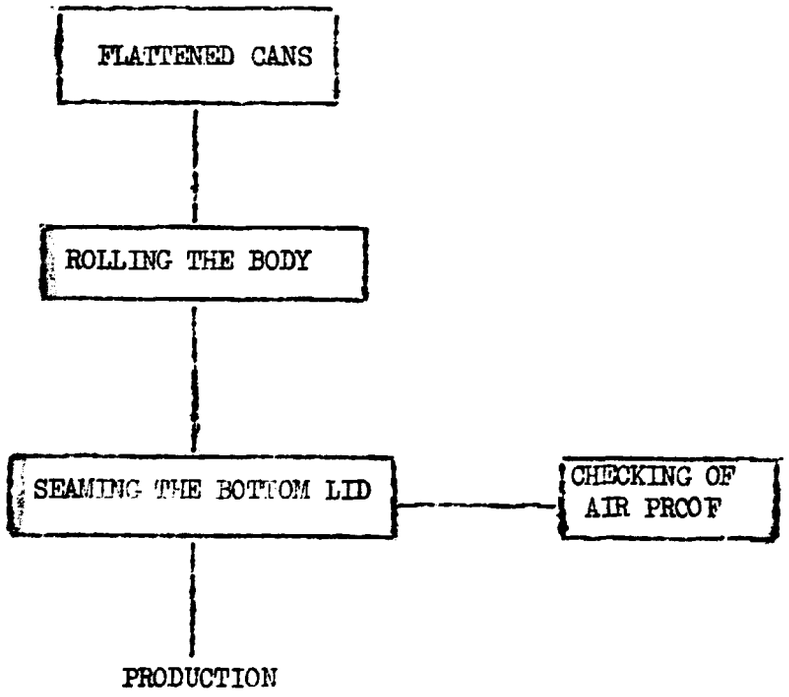
SUPPLEMENTARY PRODUCTION SCHEME NO. 9

RECONDITIONING EQUIPMENT FOR FLATTENED EMPTY CANS:

CAPACITY : 4100 Cans/hour.

OPERATIONS:



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PRODUCTION OF PINEAPPLE JUICE

The projected production line can process:

a) Natural, sterilized pineapple juice
b) Concentrated juice 65° Brix

The projected production line is a universal line that is able to process natural juice of standard quality or concentrated juice/65° Brix.

The limiting factor in the production is the evaporating unit with the evaporating capacity:

3,300 litre of water/per ton of concentrated juice.

The capacity of the production line:

1. Natural juice : 1500 litre/hour the capacity has been given by FF

Projected package : Tin 72.8 x 115.00 mm, Capacity = 16 oz = 452g.

Projected capacity in filling = $\frac{1500}{453.6}$ = 3.317 Cans/hour
= 55.1 Cans/hour
= 0.97 Cans/Sec.

2. Concentrated juice:

Projected capacity = 355 kilos pineapple concentrate/hour
= 783 pcs CANS 16 oz/hour

(see production standards No. 7)

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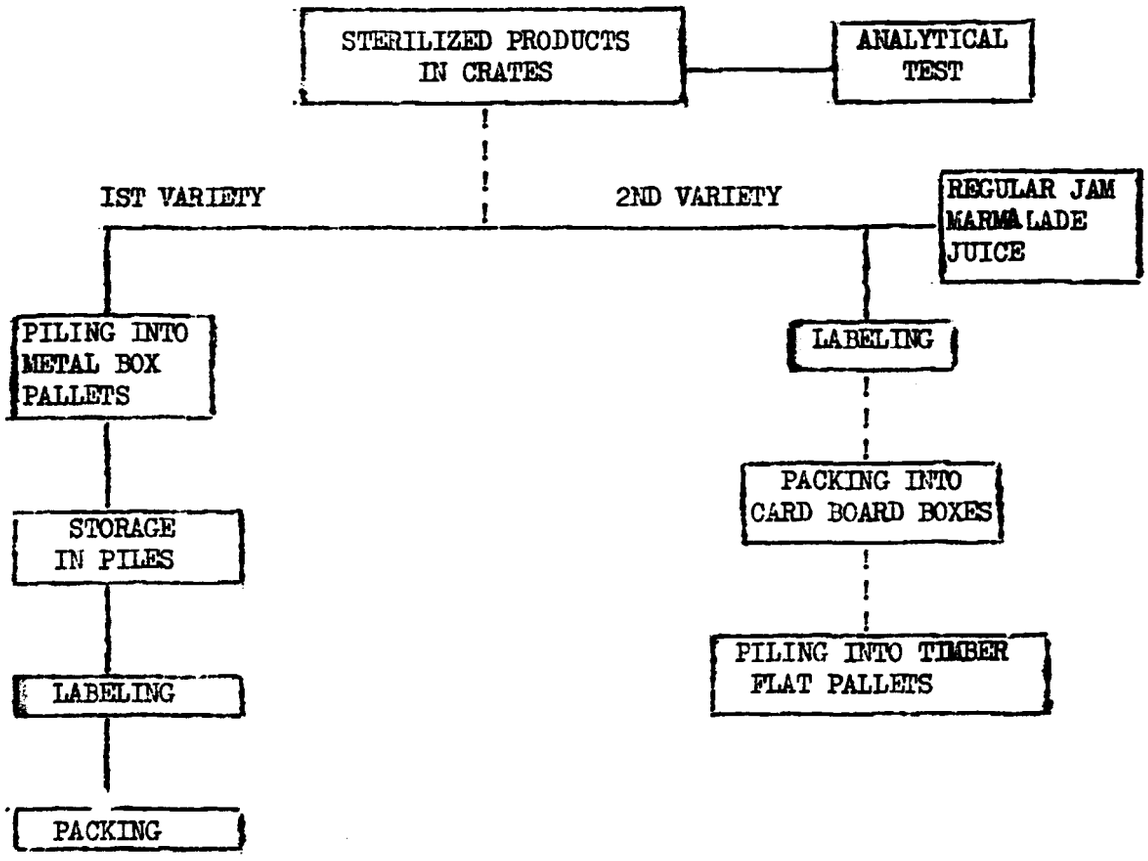
SUPPLEMENTARY SCHEME NO. 10

STORAGE OF READY PRODUCTS:



MEASSURES OF PALLETS:

METAL BOX PALLETS: LENGHT - 1200 MM
WIDTH - 800 MM
HEIGHT - 790 MM

TIMBER FLAT PALLET : 800 x 1200 MM.

MEASURES OF CORRUGATED CARD-BOARD BOXES : (APPROX.)

1) 12 Pcs. of Cans : 420 x 315 x 125 mm
2) 24 Pcs. of Cans : 420 x 315 x 125 mm

..../

LIST OF MACHINERY EQUIPMENT FOR THE PROJECTED PRODUCTION

LIST OF PRODUCTION MACHINES

SCHEME NO.1

SLICED PINEAPPLE IN SYRUP STERILISED:

1. Washing machine with shower, 1 piece
   capacity 1200 kilos pineapples/hour.

2. Decoring Device, cap. 1200 pieces/hour, 1 piece.

3. Push out of fruit cylinders device
   capacity 440 pieces/hour, 4 pieces.

4. Slicing machine with sorting belt
   capacity 2 tons/hour, 1 piece.

5. Packing table approx. length 7 m, with (2 conveyer
   belts upper belt for conveying of empty tins), 1 piece.

6. Washing machine of empty cans capacity 2000cans/
   hour, 1 piece.

7. Syruper/Filling machine,
   capacity 2000 cans/hour, 1 piece.

8. Sealing machine with steam flow closers FMC,
   capacity 2000 Cans/hour, 1 piece.

..../

LIST OF PRODUCTION MACHINES:

SCHEME NO. 2:

CUBED PINEAPPLE IN SYRUP STERILISED:

The production line is identical with production scheme No. 1.

Complementary machine is :

1. 1 DICER
to dice pineapple in cubes 9.5 mm - 19 mm,
capacity - 2000 kilo/hour, (system Urshel,USA).

LIST OF PRODUCTION MACHINES:

SCHEME NO. 3:

FRUIT DESERT IN SYRUP STERILISED:

1. Dicer - will be taken from the scheme No. 2

2. Conveyer belt 4m length, 1 piece.

3. Mixing machine capacity 2000 kilo/hour, 1 piece.

..../

LIST OF PRODUCTION MACHINES:

SCHEME NO. 4:

PRODUCTION OF JAM:

1. Vacuum jacketed steam kettle (evaporator)
   capacity 250 litres min. material : Stainless steel.

2. Crusher el. powered (disc mill) Stainless steel
   capacity 300 kilo/hour (min.).

3. Balance Tank : steel with baked enamel,
   or stainless steel, capacity 500 kilo min.

4. Washing machine for jars - capacity 1000 jars/hour.

5. Filling machine - semi-automatic,
   capacity 800-1000 jars 460 grams/hour.

6. Sealing semi-automatic machine system OMNIA, England,
   for sealing lids Ø 68 mm, capacity : 800 sealed jars/hour.

7. 2 open sterilising vats heated by vapour and cold by
   water spray. Sterilizing temperature upto 100°C.
   Measures of jars : dia 8 cm, height 10 cm (approx.).
   Dimensions of crate : 104 x 50 x 100 cm
   Sterilising cycle : 45 min.

8. Hot air drying tunnel : capacity 800-1000 jars/hour.

9. Labelling machine : Semi-automatic, capacity 1000 jars
   per hour.

..../

LIST OF PRODUCTION MACHINES:

SCHEME NO. 5:

PRODUCTION OF MARMALADE:

The production of marmalade is projected alternatively with the production of jam.

The jam line will be completed with :

1. Screening machine, with stainless screens, dia of holes 0.3 - 0.5 mm, electric powered machine capacity min. 200 kg/hour.

2. Balance vat with heating & cooling system, equipped with stirrer, from stainless steel, or steel covered with baked enamel, capacity : 500 litre.

..../

LIST OF PRODUCTION MACHINES:

SCHEME NO. 6:

PRODUCTION OF PINEAPPLE JUICE : (a) Natural(regular)
(b) Concentrated.

1. Washing machine with shower, capacity 3,200 kg. pineapple per hour.
2. Crushing unit - disc mill, capacity 1500 kilo per hour.
3. Intermediate tank - stainless steel or steel plated with plastic, capacity 1,500 litre.
4. Juice extactor FMC, electric powered, stainless steel capacity 1,500 kg/hour min.
5. Desludger centrifuge FMC, electric powered, stainless steel, capacity min. 1,500 kilo/hour min.
6. Intermediate tank, identical with the pos No. 3.
7. Pre-heater FMC, heating medium vapour 4 atp 1 151°C, i = 658 kcal/kg.
8. Evaporating unit - capacity 1,500 kilos juice, quantity of water to be evaporated per hour = 1500 - 355 kilos = 1145 kilos of water per hour.
9. Intermediate tank, identical with the pos. No. 3.
10. Filling machine : a) Natural juice 3.300 cans/hour
    size of cans 72.8 x 115.0 mm.
    b) Concentrated juice 65° Brix,
    700 cans/hour.
11. Sealing machine with steam flow closers FMC, capacity 3.300 cans/hour.
12. Cooling tunnel with water shower, capacity 3.300 cans/hour.
13. Drying tunnel -hot air drying, capacity 3.300 cans/hour.
14. Labelling : see "storage of ready products".

...../

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO. 7:

SUGAR SYRUP PREPARATION:

1. 2 numbers of vats with stirers, 900 L content each.

2. 2 numbers balance tanks, 900 L each
material : Stainless steel or steel with baked enamel, heat resisting upto 100°C.

3. 1 electric hoist (traweling wheel)
carrying capacity 250 kilo min.

4. Automatic scale, ponderability up to 150 kg.

..../

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY PRODUCTION SCHEME NO. 8:

STERILISATION OF PRODUCTS:

1st variety : 1. 5 numbers of open vats, heated by steam and cooled by spray of cold water.

2nd variety : 2. 4 numbers of pressure retorts.
1 open vat

3. Electric hoist
carrying capacity : 1000 kg.

Remark : 1. Open vats are cheaper and very easy to operate. Attainable highest temperature about 96°C.

2. Pressure retorts enable to use higher temperatures exceeding 100°C and therefore the sterilisation process is shorter.

..../

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY PRODUCTION SCHEME NO. 9:

RECONDITIONING OF FLATTENED EMPTY CANS:

1. Rolling device - Metal Box London.

2. Sealing machine - Metal Box London.

3. Pressure checking device

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

..../

LIST OF PRODUCTION MACHINES:

SUPPLEMENTARY SCHEME NO. 10:

STORAGE OF READY PRODUCTS:

1. Labeling machines el. powered
   capacity : 3,100 cans/labels per hour
   adjustable for dimensions :

   99 x 63,5 mm cans,

   99 x 118.00 cans

   72.8 x 115.00 cans

   Glue : liquid

PRODUCTION STANDARDS

1. QUALITY STANDARDS FOR READY PRODUCTS NO. 1 - 7a.

2. CONSUMPTION STANDARDS FOR THE PROJECTED PRODUCTION NO. 1 - 7a.

PRODUCTION STANDARD NO. 1

Sliced pineapple sterilised:

Resulting analytical values : Brix 18°
(Ready product) 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
Cans = 1,176 pcs.

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

Tin boxes size 99 x 118 mm	...	1188 pcs.
Lids ∅ 99.00 mm	...	1194 pcs.
Fresh pineapple GIANT Kew variety, yield 45% brix 140, acidity 0.6%	...	1,180 kg
Sugar syrup 25° brix 385 kg = sugar 100%	...	96.30 kg
Citric acid	...	3.27 kg
Labels	...	1188 pcs.
Cardboard box (12 tins)	...	99 pcs.
Glue	...	0.7 kg.
Suspensor grids	...	99 pcs.
Glue strip	...	99 m
Labels for the cardboard boxes	...	100 pcs.
1 ton of ready product	...	1176 cans.

Fruit flesh remains recovery 4% (For juice or jam). ... 47.2 kg

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PRODUCTION STANDARD NO. 2:

Cubed pineapple in syrup sterilised:

Size of the cubes 12 x 12 x 12 mm

Resulting analytical values : Brix 20°

Acidity - 0.7%

Packing: Tin box 99 x 118 mm

Nett weight of the fresh fruit	...	510 g
Weight of the sugar syrup	...	340 "
Nett weight of the content	...	850 "

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	...	1188 pcs.
Lids ∅ 99.00 mm	...	1197 pcs.
Fresh pineapple GIANT Kew variety, yield 47%, Brix 14°, acidity 0.6%	...	1085 kg.
Sugar syrup 29° Brix = 404 kg sugar 100%	...	117 kg.
Citric acid	...	3.45 kg.
Lables	...	1188 pcs.
Cardboard boxes (12 tins)	...	99 pcs.
Glue	...	0.7 kg.
Suspensor grids	...	99 pcs.
Glue strip	...	99 mm
Lables for the cardboard boxes	...	100 pcs.
1 ton of ready product	...	1,176 cans.
Fruit flesh remains recovery 2%	...	21 kg.

...../

PRODUCTION STANDARDS NO. 3:

Fruit desert in syrup sterilised:

Size of the 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 "
Nett weight of the content	...	850 "

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

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

Tin boxes size 99 x 119 mm	...	1188 pcs.
Lids ∅ 99.0 mm	...	1194 pcs.
Consumption of fresh peeled fruit mixture : 1.176 x 520	...	611.52 kg.
Unpeeled fresh pineapple yield 47%, Brix 14°, acidity 0.6%	...	442 kg.
34% fresh banana + yield 70%, Brix 150, acidity 0.1%	...	288 kg.
339% fresh guava * yield 55% Brix 100 acidity 0.1%	...	366 kg.

Peeled fresh fruit consumption:

Pineapple in cubes	207.92 kg.
Banana in cubes	201.80 kg.
Papaya in cubes	201.80 kg.
Total :	611.52 kg.

Sugar syrup 31° brix 397 kg = sugar 100%	...	123 kg.
Citric acid	...	5.20 kg.

+ * Values estimated. Exact dates were not available.

..../

Labels	...	1188 pcs.
Cardboard box (12 tins content)	...	99 pcs.
Glue	...	0.7 kg.
Suspensor grids	...	99 kg.
Glue strip	...	99 m
Labels for the cardboard box	...	100 pcs.
1 ton of ready product	...	1,176 cans.

PRODUCTION STANDARDS NO. 4:

Pineapple Jam sterilised: (50% fruit content)

Resulting analytical values : Brix 55°
Acidity 0.8 - 1.0%

Packing: Glass jar 1 lb = 0.453 kg

Nett weight of the content : 453 g

Planning unit : 1 ton (metric) = 1,000 kg
Jars number = 2,207 pcs.

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

Glass jars with OMNIA neck (dia) 68 mm	...	2.217 pcs.
Aluminium lids 'OMNIA' dia 68 mm	...	2.220
Fresh pineapple flesh rough grinded, ripe Brix 16° acidity 0.6% (500 kg flesh nett) yield 47%	...	1.064 kg.
Glucose 80° Brix	...	38.0 kg.
Sugar crystal 100° Brix	...	441 kg.
Pectin 100°	...	6.50 kg.
Citric acid crystalic	...	7 kg.
Lables	...	2.217 pcs.
Cardboard box (12 tins)	...	186 pcs.
Glue	...	0.9 kg.
Suspensor grids	...	186 pcs.
Glue strip	...	186 m
Labels for the cardboard box	...	187 pcs.
Ready product 1 ton	...	2.207 of jars.

The sugar must be throughly dry. Otherwise the batch of sugar should be adequately increased.

..../

PRODUCTION STANDARD NO. 5:

Pineapple jam - Regular quality:

Resulting analytical values : Brix 65°
acidity 0.9 - 1.0%

Packing : Glass jar 1 lb = 453 g
Nett weight of the content= 453 g of jar

Planning unit : 1 ton (metric) = 1,000 kg.
Jars = 2207 pcs.

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

Glass jar with "OMNIA' neck dia 68 mm	...	2,217 pcs.
Aluminium lids 'OMNIS' dia 68 mm	...	2,220 pcs.
Fresh pineapple flesh rough grinded ripe Brix 16° acidity 0.6 (450 kg of flesh nett), yield 47%	...	951 kg.
Glucose 80° Brix	...	38.0 kg
Sugar crystal 100° Brix	...	549.0 kg
Pectin 100°	...	6.0 kg
Citric acid crystalic	...	7.3 kg
Sodium benzoate	...	0.3 kg
Labels	...	2,217 pcs
Cardboard box (12 tins)	...	186 pcs
Glue	...	0.9 kg
Suspensor grids	...	186 kg
Glue strip	...	186 m
Labels for the cardboard box	...	187 kg
Ready product 1 ton	...	2,207 pcs. of jars

This product will be not sterilised (sugar preserve).

...../

PRODUCTION STANDARD NO. 6:

Pineapple marmalade regular quality:

Resulting analytical values : Brix 65°
Acidity : 0.8 - 1.2%

Packing : Glass jar 1 lb = 453 g

Nett weight of the content = 453 g of marmalade.

Planning unit: 1 ton (metric) = 1,000 kg.
Jars = 2,207 pcs.

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

Glass jars with 'OMNIA' neck dia 68 mm	...	2,217 pcs.
Aluminium lids 'OMNIA' dia 68 mm	...	2,220 pcs.
Fresh pineapple, flesh fine screened, ripe, Brix 16° acidity 0.6° (450 kg of flesh nett) yield 47%	...	951.0 kg
Glucose 100° Brix	...	40.0 kg.
Sugar crystal 100° Brix	...	538.0 kg.
Citric acid crystalic	...	9.3 kg.
Pectin 100°	...	7.0 kg.
Labels	...	2,217 pcs.
Cardboard box (12 tins)	...	186 pcs.
Suspensor grids	...	186 pcs.
Glue, strip	...	186 m
Labels for the cardboard box	...	187 pcs.
Ready product 1 ton	...	2,207 pcs of jars.

This product will be not sterilised (sugar preserve).

...../

PRODUCTION STANDARD NO. 7:

A. Pineapple juice:

B. Concentrated pineapple juice:

I. Production of pineapple juice:

Analytical values of the pineapple juice : Brix 16°
Acidity 0.6%

Planning unit : 1 ton of juice (1,000 kg).

Material consumption per 1 ton of pineapple juice (including production losses):

Fresh pineapple ripe, Brix 16°, acidity 0.6% yield 47%	...	2,127 kg.

Packing : Tin box 72.8 x 115

Nett weight of juice 16 oz = 453.67 g

Planning unit : 1 ton = 1,000 kg
= 2,204 tins = (Each tin of 453.67 g)

Material consumption per 1 ton of ready product:

Tin boxes size 72.8 x 115 mm	...	2,210 pcs.
Lids ∅ 72.8 mm	...	2,213 "
Labels	...	2,210 "
Cardboard boxes (24 tins)	...	92 "
Suspensor grids	...	92 "
Labels for the cardboard boxes	...	92 "
Glue strip	...	92 m
Glue	...	0.6 kg.

II. Concentrated pineapple juice:

Analytical values : Brix 65°
acidity 2.46%

Material consumption per 1 ton of pineapple concentrated (including production losses):

Pineapple juice Brix 16°, acidity 0.6%

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

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

X = 4.0625 x 1000 = 4,062 kg pineapple juice Brix 16°

+ 4% loss = $\frac{163 \text{ kg}}{4,225}$ kg of pineapple juice. ..../

Concentrated pineapple juice:

Packing : Tin box 72.8 x 115 mm

Nett weight of concentrated juice = 453.6 x 1.25 (S.G.)
= 567 g

Planning unit: 1 ton = 1,000 kg = 1,764 cans each 567 g

Material consumption per 1 ton of ready products:

Tin boxes size 72.8 x 115	...	1800 pcs.
Lids ø 72.8	...	1804 "
Labels	...	1800 "
Cardboard boxes (24 tins)	...	74 "
Suspensor grids	...	74 "
Labels for the cardboard boxes	...	74 "
Glue strip	...	74 "
Glue	...	0.5 kg.
Fresh pineapple brix 16°	...	8,986 kg.

Total consumption per 1 ton of concentrate 65° Brix
4,225 kg of pineapple juice.

Quantity of evaporated water per 1 ton concentrated juice 65° Brix = 3,?25 kg of water.

Consumption of fresh pineapple for the production of 1 ton (1,000 kg) of pineapple concentrate 65° Brix :
8,986 kg of fresh pineapple.

..../

3. PACKING MATERIAL FOR SINGLE PRODUCTS:

The projected production will be packed :

1) Sliced pineapple in syrup sterilised.

Cans size 99 x 118.00 mm.
(alternatively 99 x 63.5 mm)

2) Cubed pineapple in syrup sterilised.

Cans size 99 x 118.00 mm
(alternatively 99 x 63.5 mm)

3) Fruit desert in syrup sterilised.

Cans size 99 x 118.00 mm
(alternatively 99 x 63.5 mm)

4) Jam, marmalade.

Glass jar, dia 80 mm, content 1 lb = 0.454 kg. nett.
with OMNIA neck, ∅ dia 68 mm.

Lid:

Aluminium lid OMNIA with PVC seal, dia 68.0 mm.

5) Pineapple juice natural.

Pineapple juice concentrated.

Cans size 72.8 x 115.00 mm, content nett. 16 oz = 453.6 g

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4. MEANS OF STERILISATION:

All products being supposed to be processed in this plant belong to the group of so called sour products, their concentration of ions, expressed in pH is (numeric) lower than 4.5 pH. Therefore no temperature over 100° C is necessary, unless short time sterilisation technology would not be applied.

As mentioned in the production scheme, part "Sterilisation" open sterilisation vats with cold water showers for cooling would be considered as satisfactory.

They are not expensive and easy to handle.

When sterilising, following peralelity is calculated :

Sliced pineapple 1764 pcs of Cans 99/118 mm/hour.

Pineapple jam
sterilised in jars 828 pcs/hour

Projected sterilising regime:

1) Pineapple (sliced) in syrup 99 x 118 mm can :

15 min. rising up
20 min. sterilisation to = 90°C
20 min. cooling.
55 min./cycle

2) Jam sterilised:

Jar ∅ 80 mm, height approx. 90 mm, content 1.0 lb
Hot filling :
Sterilisation 15 min. t° = 85°C
Cooling 20 min
35 min/cycle

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Capacity of 1 sterilisation crate:

Ist variety: 1) 480 pcs of cans 99 x 118 mm
2) 840 pcs of jars 80 x 90 mm(approx.)

Real need of sterilisation vats:

Sliced pineapple (or its alternatives) 3.36 = 4 vats
Jam sterilised = 1 vat

total need of sterilisation vats ... 5 vats.

2nd variety: Pressure retorts:

2 crate retorts, capacity of 1 crate 220 pcs of cans
capacity of 1 retort = 440 cans

Pineapple sterilised (or its alternatives)

Real need of retorts 3.66 ..... 4 retorts
Jam sterilised open vat ..... 1 vat

total need : 5 retorts.

3 crate retorts that would minimise the number of retorts are not recommended with regard to the projected capacity.

...../

MATERIAL CONSUMPTION: FRUIT, INGREDIENTS, PACKING MATERIAL

PER : 1 ton
1 hour
8 hours

Consumption per	1 ton of ready product	1 hour production	8 hour (1 shift) production
Sliced pineapple sterilised:			
Tin boxes 99 x 118mm pcs.	1188	1782	14,256
Lids ∅ 99 mm pcs.	1194	1791	14,328
Sugar 100% kg	96.30	144.45	1,155.6
Citric acid kg	3.27	4.90	39.4
Labels pcs	1.188	1782	14,256
Cardboard boxes 12 tins cont.	99	148.5	1,188
Suspensions grids pcs	99	149.5	1,188
Glue kg	0.7	1.05	8.4
Glue strip m	99	148.5	1,188
Lebels for the cardboard boxes pcs.	100	150	1,200
Fresh pineapple kg	1.180	1.770	14,160

Consumption per	1 ton of ready product	1 hour production	8 hours (1 shift) production
Cubed pineapple sterilised:			
Tin boxes 99 x 118 pcs	1188	1.782	14,256
Lids ø 99 mm pcs.	1194	1.799	14,328
Sugar 100% kg	117	175	1,404
Citric acid kg	3.45	5.17	41,4
Labels pcs	1188	1782	14,256
Cardboard boxes (12 tins) pcs.	99	149.0	1,188
Sunspensor grids pcs.	99	149.0	1,188
Glue kg	0.7	1.05	8.4
Glue strip m	99	1490	1,188
Labels for the Cardboard boxes pcs.	100	150	1,200
Fresh pineapple kg	1085	1628	13,020

MATERIAL CONSUMPTION: FRUIT, INGREDIENTS, PACKING MATERIAL:

PER : 1 ton
1 hour
8 hours

Consumption per	1 ton of ready product	1 hour production	8 hours (1 shift) production
Fruit desert in syrup sterilised:			
Tin boxes 99 x 118 pcs	1188	1782	14,256
Lids pcs	1194	1.791	14,328
Sugar crystal 100% kg	123	184.5	1,476
Citric acid kg	5.20	7.8	62.4
Labels pcs.	1188	1.782	14,256
Cardboard boxes (12 tins) pcs.	99	149.0	1,188
Suspensions grids pcs.	99	149.0	1,188
Glue kg	0.7	1.05	8.4
Glue strip m	99	149.0	1,188
Labels for the cardboard boxes pcs.	100	150	1,200
Fresh pineapple	442	663	5,304
Fresh banana	288	432	3,456
Fresh papaya	366	549	4,392

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MATERIAL CONSUMPTION:

PER : 1 ton
1 hour
8 hours

Consumption per	1 ton of ready product	1 hour production	8 hours production
Pineapple Jam sterilised:			
Glass jars pcs.	2.217	832	6651
Aluminium lids 'OMNIA' ∅ 68 mm pcs.	2.220	832	6651
Glucose 80° Brix kg	38	14.25	114
Sugar crystal 100° Brix kg	441	166	1,323
Pectin 100° kg	6.50	2.43	19.5
Citric acid crystalic kg	7.0	2.63	21
Labels pcs	2.217	831	6651
Cardboard boxes (12 tins) pcs.	186	70	560
Glue kg	0.9	0.33	2.70
Suspensor grids pcs.	186	70	560
Glue strip m	186	70	560
Labels for the cardboard boxes pcs.	187	70.1	561
Fresh pineapple kg	1.064	399	3,192

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MATERIAL CONSUMPTION

PER : 1 ton
1 hour
8 hours

Consumption per	1 ton of ready product	1 hour of production	8 hours production
Pineapple Jam regular:			
Glass jars pcs	2.217	832	6651
Aluminium lids 'OMNIA' pcs	2.220	832	6651
Glucose 80° Brix kg	38	14.25	114
Sugar crystal 100° Brix kg	549	206	1,647
Citric acid crystalic kg	7.3	2.73	21.9
Pectin 100° kg	6.0	2.25	18.0
Sodium benzoate kg	0.3	0.11	0.88
Labels pcs	2217	832	6651
Cardboard boxes (12 tins)pcs	186	670	560
Glue kg	0.9	0.33	2.70
Suspensor grids pcs	186	70	560
Glue strip m	186	70	560
Labels for the cardboard box pcs.	187	70.1	561
Fresh pineapple kg	951	356.62	2853

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MATERIAL CONSUMPTION:

Consumption per	1 ton of ready product	1 hour of production	8 hours production
Pineapple marmalade:			
Glass jars pcs	2217	832	6651
Aluminium lids 'OMNIA' Ø 68mm pcs.	2220	832	6651
Glucose 100° Brix kg	40.0	15.00	120
Sugar 100° Brix kg	538.0	201.75	1,614
Citric acid crystalic kg	9.3	3.48	27.9
Pectin 100°kg	7.0	2.62	21.0
Labels pcs	2217	831	6651
Cardboard boxes(12 tins)pcs	186	70	560
Suspensor grids pcs.	186	70	560
Glue strip m	186	70	560
Labels for the cardboard box pcs.	1872	71	586
Fresh pineapple kg	9510	356.6	2,853

..../

MATERIAL CONSUMPTION:

Consumption per	1 ton of ready product	1 hour of production	8 hours production
Pineapple juice natural:			
Tin boxes 72.8 x 115 mm pcs	2210	3.300	26520
Lids ∅ 72.8 mm pcs	2213	3.319	26556
Labels pcs	2.210	3.315	26520
Cardboard boxes(24 tins)pcs	92	138	1104
Suspensor grids pcs	92	138	1104
Labels for the cardboard boxes pcs.	92	138	1104
Glue grip m	92	138	1104
Glue kg	0.6	0.9	7.2
Fresh pineapple kg	2.127	3190	25,524
Concentrated pineapple juice:			
Tin boxes size 72.8 x 115 mm pcs	1800	640	5,120
Lids ∅ 72.8 mm pcs	1804	641	5,123
Labels pcs.	1800	640	5,120
Cardboard boxes(24 tins)pcs	74	26.2	210
Suspensor grids pcs.	74	26.2	210
Labels for the cardboard boxes pcs.	74	26.2	210
Glue trip m	74	26.2	210
Glue kg	0.5	0.18	1.42
Fresh pineapple Brix 16° kg	8.986*	3190	25,524

* from 1,500 natural juice/hour.

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6. Claims for quality:

a) Fruits - 1. Fresh pineapple

Quality demands :

1st quality:

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

The minimum diameter of the fruit in the middle : 12.5 cm.

The colour : 70% yellow husk (skin).

Length of score : max. 3 cm.

Analytical value : mim 15° Brix

Flesh : Compact, firm, without holes and deep penetrated blossom cups ("eyes").

Colour of the flesh : typical yellow, black spot in the flesh are not admitted.

2nd quality:

Quality demands are the same. Only the diameter of the fresh fruit is minimum 11 cm.

3rd quality:

Quality demands are the same. The diameter of the fruit is upto 9 cm (in the middle) allowed. The over-ripe fruits are not allowed, but the husk may be total yellow.

Packing of the pineapple:

The pineapple will be transported in special crates made from cratewood, capacity 20 kg. of fresh fruit each. The crates must be clean, dry, compact without any foreign smell;

To each crate fruit of the same quality are piled only.

The dimensions of the crates will be uniform and the dimensions must be modulus measures of the timber pallet 80 x 120 mm. (The pallet will hold 4 crates in 1 shift).

.../

2. Fresh banana:

Quality demands:

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

Size : length min. 16 cm, diameter of the fruit : 4 cm in the middle.

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 only in timber crates, each 15 kg. nett. The size of crates will be the same as with pineapple (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.

Colour : Slight yellow-red, typical.

The skin : clean, without daneges due to knocking, sound, dry.

Flesh : firm, compact, changes in colour or black spots are not admitted.

Packing of Papaya:

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

The size of crates will be the same as with pineapple.

..../

6) Ingredients:

Sugar type: crystalline sugar, refined.

Size of crystals : middle size, export quality.

Colour : White solely, brown shade not admitted.

Impurities : None (Nil).

Smell : Nil - molasses smell not admitted.

Humidity : max. 0.1%

Packing : Jute bags.

Weight : 50 kg. or 100 kilo 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.

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 quality of tin in grams used for 1 m^2 of the plate. The perfect quality of tin-coated sheet is about 7g/m^2, with tin plated sheet 5-69/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 concetrated juice lacquered tins are recommended (high content of acids).

Dimensions : see part VII head 3.

..../

Jars : Glass-pressed jars, the content 1 lb = 454 g, heat resisting upto 100°C. Lids are processed from aluminium plate coated with baked lacquered shift.

Cardboard boxes: Corrugated cardboard paper, or container board 1250g/m^2.

Each container will contain :

1) Tins 99 x 118.0 mm : 12 Cans
2) Tins 99 x 63.5 mm : 24 Cans
3) Tins 972 x 115 mm : 24 Cans
4) Jars, approx. 60 x 900 mm : 24 Cans.

Lids: Aluminium lids (OMNIA) with PVC sealing mass, dia 68 mm heat resisting up to 100°C. Lids are processed from aluminium plate coated with baked laoquered shift.

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XI. POWER DEMAND ESTIMATED:

As no exact types of machinery equipment have been projected, some particular demand could be calculated in this stage :

Product	Quantity 1 ton = 1000 kg.	Steam demand	Electric power demand KW	Water Meter^3
Sliced pineapple in syrup sterilised (+)	1 ton	0.8	15.-	8.0
Jam or marmalade	1 ton	2.2	20.-	4.0
Pineapple juice	1000	0.5	12.-	7.0
Concentrated juice (multiple effect evaporator)	1 ton	1.48	12.-	3.0
		4.78	59.-	22.0

Remarks:

+ Sliced pineapple is the representative of the production line No.1 where cubed pineapple or fruit desert can be produced.

+ Water will recirculated.

Approximately need of water per second = 0.0069 m^3 = 6.9 1/s

+ washing of machinery equipment and others	= 1.1 1/s
+ personal need, 390 workers	= 1.0 1/s
Total need of drinking water	9.0 1/sec.

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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.

It is presumed that the fruit will be dispatched from the orchards into the plant by farmers boats, as pineapples are mostly planted on the slopes close to the dam.

Most probably the plant will be located on the dam bank. Near the plant the boat landing with plat form will be installed. The farmers will put there their fruits according to the quality in special crates made from cratewood. By means of installed scale on the platform, there will be adjusted uniform weight of each crate. After then the technician of the plant will take over the fruit as to the quality and quantity. After taking over the fruit will be piled on the timber pallets size 80 x 120 cm (12 crates each) and by means of pallet truck dispatched into the sorting room or cold storage.

b. Means of transportation:

As mentioned above, in order to spare the space, when material handling and storing, in principle pallets will be used inside the plant. Loaded pallets will be moved by means of pallet trucks or counter balanced fork lift electric truck or hand operated lift trucks.

c. Ingredients and chemicals:

For storing of ingredients and chemicals a special store equipped with racks from profiled steel will be installed. Sugar and citric acid will be piled on timber pallets.

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d. Packing material:

The largest volume of packing material represent metal boxes (cans) that will be packed in flattened form into returnable plywood or cardborad boxes.

Glass jars and lids (covers) will be delivered also in card board boxes fixed inside with wood fibre against break.

Metal lids will be delivered into cardboard boxes too.

XI. STOCKING:

1) Raw material (Fruit):

The stock of fruit for one day production will be stored in the open shed of the front part of sorting room. It will accommodate 42.88 tons of fresh fruit. This fruit will be stored on timber pallets in timber wood crates 1 pallet = 12 crates x per 20 kilos = 240 kilo of fresh fruit.
One pallet size 80 x 120mm takes = 0.96 m^2 space.

Storage area needed ... . 178 m^2
Storage area double pilled pallets needed 89 m^2

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

Except this there will be a cold store with the capacity of 1000 tons for storing at disposal.

Cold store:

The fresh fruit will be stored also in crates, each 20 kilo. 1 pallet will hold 12 crates = 240 kilo of fresh fruit.

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The height of one loaded pallet is 152 cm.
3 pilled pallets result 4.56 m height +0.50 m spare space
= 5.06 m height.

720 kg of fruit will take the area of 1.22 m^2

Total area of cold store:

3½ weeks running the plant after season per 281.3 tons of fresh fruit/week claims 1000 tons cold space.

1 pallet stack claims 1.22 m^2 space.

Stocking of 1000 tons fresh fruit in cooled storage needs 1,389 pallet stocks :
Total area of cold storage needed : 1700 m^2.
To enable economical running of this cold store, it will be devided into three chambers.

Needed temperature : 7.0°C, Relat, humidity 85%, air change 2 x within 24 hours.

Ingredients and chemicals:

Sugar - in bags 100 kg nett.
Consumption of sugar per one day = 2,478 kg;
20 days supply = 50 tons
1 pallet holds 600 kg of sugar
1 stack = 2 pilled pallets = 1.200 kg = 1.12 m^2 space.
Space for 50 tons of sugar needs 42 m^2 space
+ 25% .... 10.5 m^2 space
Total : 52.5 m^2

Glucose - in drums 200 kg

40 days supply = 4.6 tons (4,600 kilo)
1 m^2 = 800 kilo $\frac{4.600}{800}$ = 6 m^2 area
Pectin in plywood druns 50 kg
90 days supply per 19.50 kg = 1,755 kg
1 m^2 = 150 kg
area needed $\frac{1755}{150}$ = 12 m^2

...../

Citric acid - in PE bags per 50 kg

90 days per 60.20 kg = 5,421 kg.

1 m^2 = 1000 kg

area needed = 6 m^2

Glue - in drums 100 kg

90 days per 13.80 kg = 1242 kg

1 m^2 = 250 kg

area needed = 5 m^2

Ingredients and Chemicals - store are needed :

Summary:

Sugar 51 m^2

Glucose 6 m^2

Pectin 12 m^2

Citric acid 6 m^2

Glue 5 m^2

Total = 80 m^2

Height of store 410 m

3. Packing material:

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

4. Ready products:

Stocking of ready products is projected in two varieties:

1. Dry cans will be labeled and packed into cartons, piled on the timber pallets and stocked

1 pile = 3 pallets.

...../

2. Dry cans will be piled into metal box pallets and stocked 1 pile = 3 pallets.

Storage Capacity:

The production capacity of the whole season takes:

788 tons of sliced pineapple(or its equivalent)
197 " of jam
186 " of concentrated juice
1,171 tons total

It is projected, that from this amount there will be 470 tons send out from the plant within the season. 60% of the whole production, i.e. 702 tons, will be stored in the stock of ready products in this plant.

Beside this, especially concentrated juice, as recommended in the conclusion, can be stored in the cold storage

1st variety:

Metal box pallet size 1200 x 800 mm, height 790 mm
Loading capacity : 1000 kg (1 ton)

1)	Number of tins size 99 x 118 mm in (1 shift)	96 tins
	Number of shifts	6
	1 pallet holds	576 tins
2)	Number of tins size 99 x 63.5 mm in 1 shift	96 tins
	Number of shifts	12
	1 pallet holds	1152 tins
necessary area for one pallet		1.12 m^2
number of stacked pallets		3 pcs.

Capacity of one stack: a) 3 pallets, 3 x 576 = 1728 tins size 99 x 118 mm.
b) 3 pallets, 3 x 1152 = 3,456 tins size 99 x 63.5 mm.

1.12 m^2 storage area presents:
Stocking capacity of ready products
1 stack/3 pallets = 1,728 x 0.850 kg = 1,469 kg
Minimum height of the storage room = 3.6 m

..../

Capacity of pallets:

2nd variety:

Timber flat pallets

1) 6 cardboard boxes each 12 pcs of tins 99 x 118 mm in one shift .... 72 tins
Number of shifts in 1 pallet 8
Total number of card board boxes/pallet 48
Total number of cans/one pallet ... 376 pcs.

2) Tins 99 x 63.5 mm

6 cardboard boxes each 24 pcs of tins 99 x 63.5 mm ... 144 tins
Number of shifts in 1 pallet ... 8
Total number of cardboard boxes ... 48
Total number of cans/one pallet ... 1152

Necessary area for one pallet 1.12 m^2
Number of stacked loaded pallets 3

1.12 m^2 storage area

Presents: 1) 3 x 48 cardboard boxes 144 pcs.
= 3 x 576 tins = 1,728 pcs.

2) 3 x 48 cardboard boxes = 115 x 3 tins = 3,456 pcs.

Its carrying capacity of ready products 1,728 x 0.850/stack
= 1,468 kg

Minimum height of storage room 4.0 m

Stocking of Jam and marmalade in jars:

The whole production will be stored in cardboard boxes, ready to sale.

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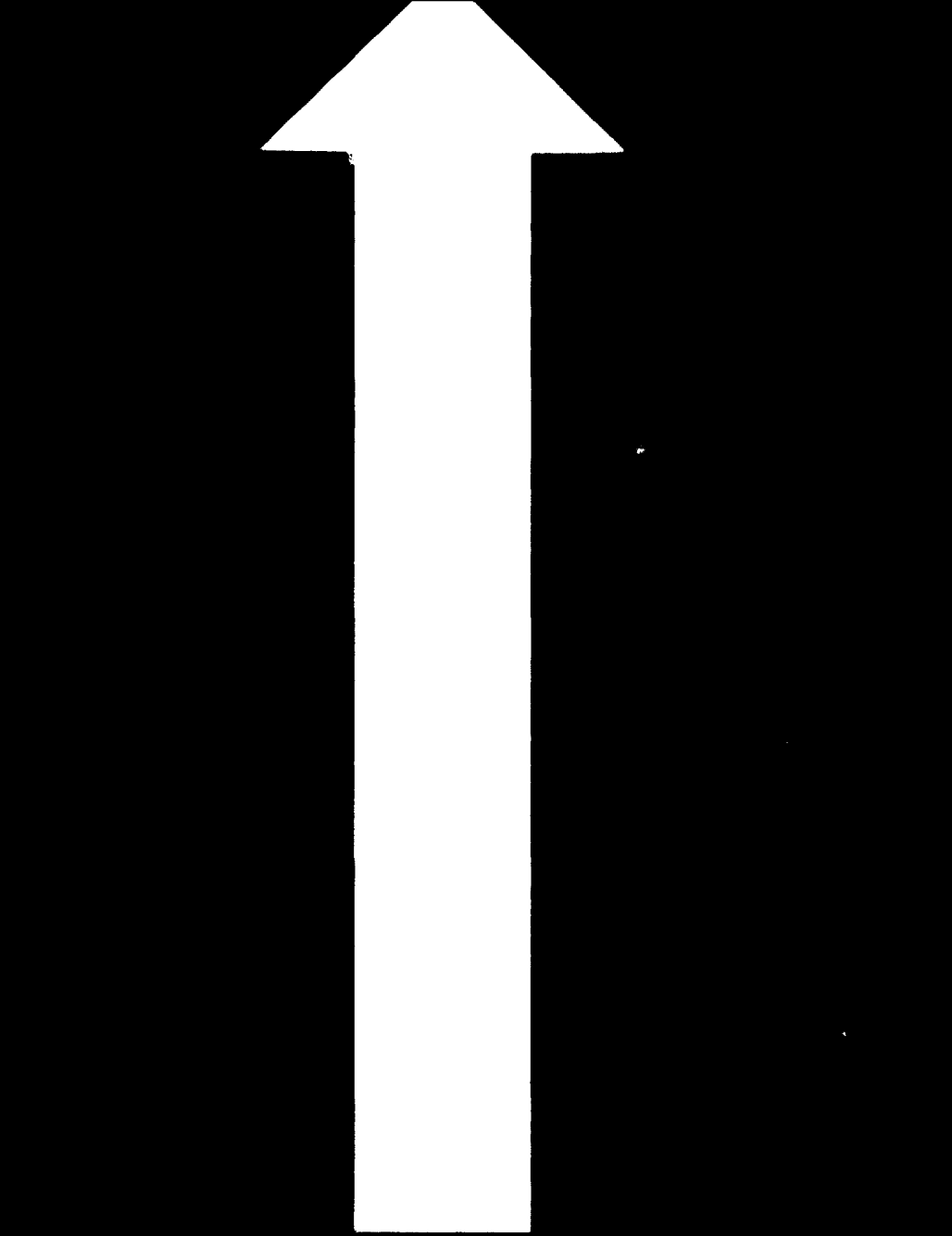

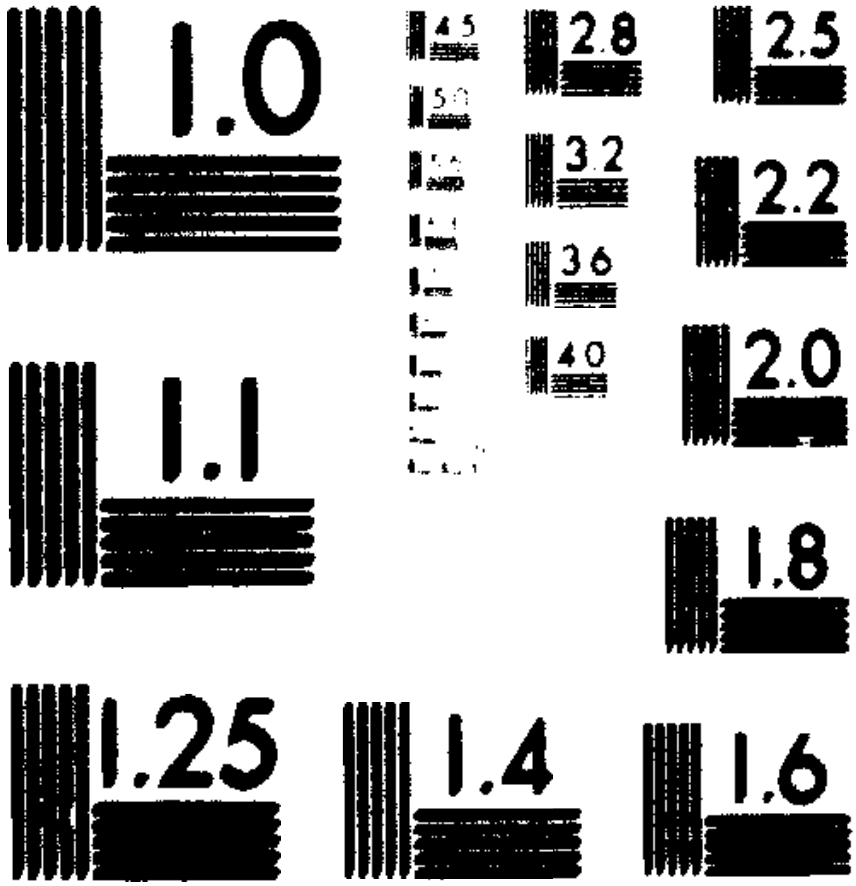

Timber flat pallets:

1. 6 cardboard boxes each 20 pcs of jars dia 80 mm in one shift ... 120

   Number of shifts in 1 pallet ... 9

   Total number of cardboard boxes/1 pallet 54

   Total number of jars/pallets ... 1080

   Necessary area for 1 pallet 1,12 m^2

   Number of stacked loaded pallets 3

1,12 m^2 storage area:

Presents : 3 x 54 boxes = 162 cardboard boxes.
3 x 1080 = 3,240 jars.

stacking capacity of ready products 3,240 x 0.4536 kg
= 1,470 kilo.

Minimum height of the storage room = 3,96 m = 4.0 m(approx.)

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Stocking of pineapple juice:

2nd variety:

Timber flat pallets - The ready product = cans will be labeled before packed into the cardboard boxes(ready for sale).

1. 6 cardboard boxes each 24 pcs of cans dia 72.8 mm x 115mm/1 shift	....	144 cans.
Number of shifts/pallet	....	8
Total number of cardboard boxes/pallet		48 boxes
Total number of cans/pallet	...	1152 cans
Number of stacked pallets		3
Capacity of 1 stack = 3 pallets		3,456 cans
Stocking capacity of ready product 3.456 x 6.456	...	1576 kg.
Mimimum height of the storage room		4.0 metre.

...../

Stocking of pineapple juice:

1st variety:

The ready product = cans will be pilled into the metal pallets without labels.

Metal box pallet size 1200 x 800 mm, height 790 mm.

Loading capacity:	...	1000 kg
1) Number of tins size 72.8 x 115 mm/1 shift		150 cans
Number of shifts		6
1 pallet holds		900 cans
Necessary area per 1 pallet		1.12 m^2
Number of stacked pallets		3
Capacity of 1 stock = 3 pallets		2,700 cans
Stocking capacity of ready products/ 1 pallet = 2.700 x 0.4534	...	1,225 kg
Minimum height of the storage room		3.6 m

Projected capacity of the store for ready product:

For the projected production following area will be needed:

	1st variety	2nd variety
1. 472.5 tons sliced pineapple :	$\frac{412.500}{1.469}$ = 327 stacks.	$\frac{472.500}{1.469}$ = 321 stacks.
2. 118.1 tons jam and marmelade:	$\frac{118.100}{1.470}$ = 80 stacks.	$\frac{118.100}{1.470}$ = 80 stacks.
3. 111.8 tons pineapple juice cans.	$\frac{111.800}{1.225}$ = 91 stacks.	$\frac{111.800}{1.576}$ = 70 stacks.
Total stacks :	492	471
1,12 m^2/pallet	551 m^2	528 m^2
+ 25% acces roads	138 m^2	132 m^2
Stocking area for ready products	689 m^2	660 m^2
Height of the store	3.6 m^2	4.0 m

...../

CONCLUSION:

Two varieties were compared to consider the more proper feasibility method when stocking ready products.

No distinctive differences arroused. Taking into consideration the initial costs of steel box pallets, the second variety seems to be more economically.

Handling and stacking of pallets will be performed by means of counter balanced fork lift trucks.

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MAN POWER DEMAND

PRODUCTION SCHEME NO. 1 - 6

SUPPLEMENTARY SCHEME NO. 7 - 9

MAN POWER DEMAND:

PRODUCTION SCHEME NO.1:

SLICED PINEAPPLE IN SYRUP STERILISED:

Washing :	4	workers.
Peeling : 1 pineapple = 2 minutes, 1180 pcs	39	"
Decoring: push out the cylinders ...	52	"
Slicing	4	"
Sorting	6	"
Washing of tins	2	"
Packing 37 sec/1 tin	14	"
Filling with sugar syrup ...	1	"
Sugar syrup preparation ...	2	"
Deaeration	1	"
Setting lids	1	"
Sealing	1	"
Pilling into sterile crates ...	2	"
Total workers	129	workers.
Chief	1	"
Foremen	3	"
TOTAL	133	"

From that 91 workers engaged with manually peeling and decoring only.

MAN POWER DEMAND:

PRODUCTION SCHEME NO.2:

CUBED PINEAPPLE STERILISED:

Washing	...	...	4 workers
Peeling	...	...	39 "
Decoring	...	...	26 "
Sorting	...	...	6 "
Washing of tins	...	...	2 "
Packing	...	...	14 "
Sugar syrup filing	...	...	1 "
Sugar syrup preparation	...	...	2 "
Deaeration	...	...	1 "
Setting lids	...	...	1 "
Piling into sterile crates	...	...	2 "
Total	...	...	98 workers
Chief	...	...	1
Foremen	...	...	3
Total	...	...	102

MAN POWER DEMAND:

PRODUCTION SCHEME NO.3:

FRUIT DESERT STERILISED:

Washing	3 Workers	
Peeling of 422 kg pineapple 280 kg banana 366 kg guava = 2,336 min.	38	"
Dicing	2	"
Sorting	6	"
Weighing and Mixing	2	"
Washing of tins	2	"
Filling cans with fruit 20 sec/1 tin ...	7	"
Filling with sugar syrup	1	"
Sugar syrup preparation	2	"
Deaeration	1	"
Setting lids	1	"
Sealing	1	"
Filling of sterilecrates	2	"
Total	64 workers	
Foremen	2	
MANPOWER TOTAL	66 workers	

MAN POWER DEMAND:

PRODUCTION SCHEME NO.4:

PRODUCTION OF JAM STERILISED AND REGULAR

	Jam Sterilised	Regular
Washing of fruit	2	2
Peeling, decoring 532 kg pineapple	17	16
Crushing of fruit	2	2
Evaporator control	2	2
Washing of jars	1	1
Bottling	2	2
Setting lids	1	1
Air cooling	-	1
Sealing	2	2
Piling into sterile crates	1	-
Sterilisation	1	-
Drying	1	1
Preservation	-	1
Labeling	-	2
Packing	2	2
Palletisation	1	1
	35	35
Foreman	1	1
TOTAL :	36	36

MAN POWER DEMAND:

PRODUCTION SCHEME NO.5.

PRODUCTION OF MARMALADE:

Washing fruit in crates	...	2 workers.
Peeling and decoring $\frac{0.951 \times 375 \times 2}{60}$		12 "
Crushing	...	2 "
Screening	...	2 "
Evaporation	...	2 "
Washing of jars	...	1 "
Bottling	...	2 "
Air cooling	...	1 "
Preservation	...	2 "
Setting of lids	...	1 "
Labeling	...	2 "
Packing	...	2 "
Palletisation	...	1 "
		32 workers.
Foreman	...	1
TOTAL:	...	33

MAN POWER DEMAND

PRODUCTION SCHEME NO.6:

PINEAPPLE JUICE & CONCENTRATED:

	Workers	Juice	
		Regular	Concentrated
Washing 3200 pcs/hour	"	4	4
Peeling 3200 pcs pineapple	"	107	107
Crushing	"	2	2
Extractor operation	"	1	1
Desludger	"	1	1
Pre-heater unit	"	1	1
Evaporating unit operation	"	-	2
Hot filling(siruper)	"	2	2
Washing of cans	"	2	2
Setting of lids	"	2	1
Seaming	"	2	1
Spray cooling	"	1	1
Drying of cans	"	1	1
Anticorosion treating	"	4	2
Labeling	"	4	2
Packing	"	6	3
Palletisation	"	3	2
Total Workers		143	135
	Foremen	4	4
	TOTAL :	147	139

MAN POWER DEMAND

SUPPLEMENTARY PRODUCTION SCHEME NO.7:

SUGAR SIRUP PREPARATION

Operator	...	1
Assistant	...	1
TOTAL	...	2

MAN POWER MEMAND:

SUPP MENTARY PRODUCTION SCHEME NO.8:

STERILISATION OF PRODUCTS:

Retort Operator	...	1
Assistant	...	1
TOTAL	...	2

MAN POWER DEMAND:

SUPPLEMENTARY PRODUCTION SCHEME NO.9:

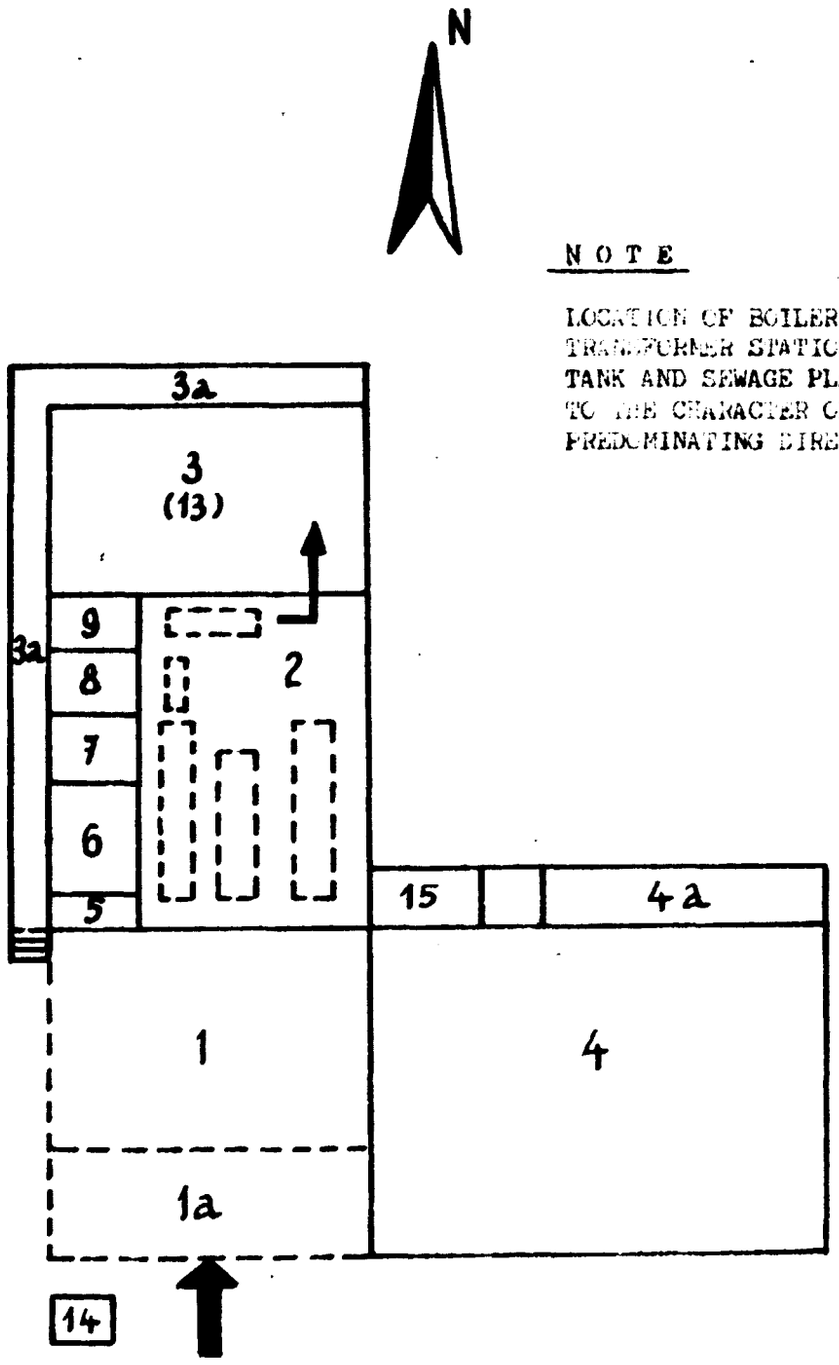
RECONDITIONING OF FLATTENED CANS:

Rolling machine operator	...	3
Seamer operator	...	3
TOTAL :	...	6

LAYOUT OF THE

PRODUCTION PLANT

LAYOUT OF THE PRODUCTION PLANT



NOTE

LOCATION OF BOILER PLANT, TRANSFORMER STATION, WATER PLANT, TANK AND SEWAGE PLANT ACCORDING TO THE CHARACTER OF THE SITE AND PREDOMINATING DIRECTION OF WIND

PRE-FEASIBILITY STUDY

PINEAPPLE PROCESSING PLANT

RANGAMATI

PROJECTED BY: J.V.SKALA UNIDO/UNDP

DESIGNED BY:

6TH SEPT. 1978

LEGEND TO THE LAY OUT OF THE PRODUCTION PLANT

1. SORTING ROOM - OPEN SHED WITH
1a. SPACE FOR STORING OF FRESH FRUIT
2. PRODUCTION LINES No. 1, 2, 3 WITH STERILISATION AND DRYING OF CANS
3. STORAGE OF READY PRODUCTS AND PACKING MATERIALS, RECONDITIONING OF EMPTY CANS
3a. RAMP
4. COOLING PLANT
4a. ENGINE ROOM
5. LABORATORY
6. STORAGE OF SUGAR
7. STORAGE OF CHEMICALS
8. WORKSHOP 1
9. WORKSHOP 2
10. DRESSING ROOM
11. LAVATORIES
12. TOILETS
13. OFFICES 2ND FLOOR
14. SCALE
15. PRODUCTION OFFICE

PRODUCTION BUILDING:

Is projected as ferroconcrete ground floor monobloc.

To save the acreage, the rooms for office will be located upon the stock of ready products.

Weather conditions allow to project the building in unloading style, that will have favourable influence on the errection costs.

Floors : Striked concrete with dilatation joints, declinity approx 1‰ to catch drain.

Drains : Protected against penetration of insect from outside.

Roofing : Monitor roof.

Ventilation : By exhaustors installed in the monitors.
capacity : 2 x change of the air/hour.

Windows : Protected by nets against insect.

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

Roofing : Transite desks (from Chittagong) or corrugated sheets.

Floor : Striked concrete with dilatation joints, declinity approx 1½‰.

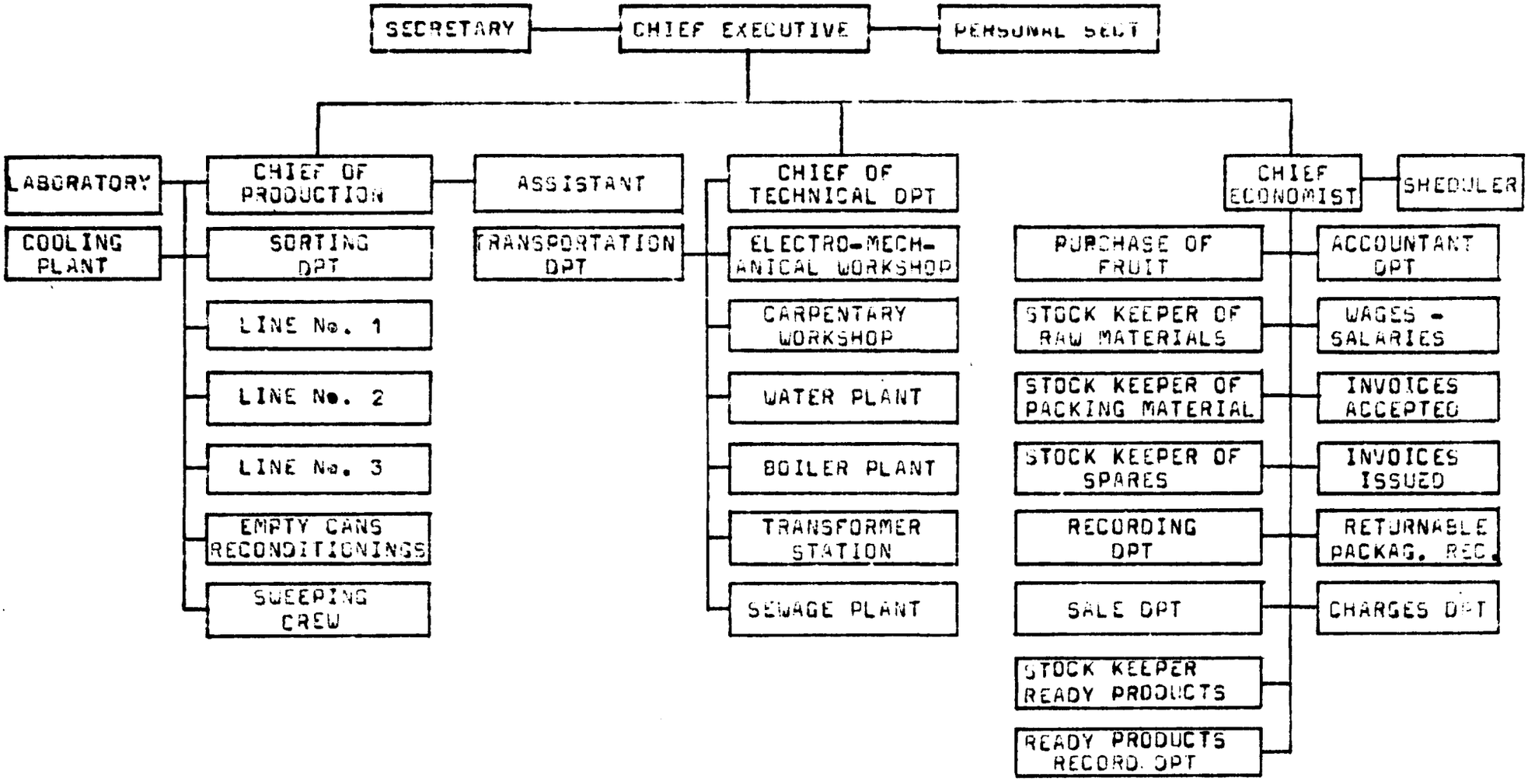
Drainage : All sewage water will be lined into the sewage plant for treating.

PLANT ORGANIZATION

ORGANIZATIONAL SCHEME

PRODUCTION CAPACITY

MAN POWER DEMAND



ORGANIZATIONAL SCHEME

PRE-FEASIBILITY STUDY

PINEAPPLE PROCESSING PLANT

PROJECTED BY: J.V.SKALA UNIDO/UNDP

DESIGNED BY:

5TH SEPTEMBER 1978

TABLE No. 11

1. PRODUCTION CAPACITY:

2. MAN POWER DEMAND:

No.	Production Scheme	Capacity/hour		Man Power Demand		
		Pcs cans	Tons	Workers	Foreman	Total
1.	Sliced pineapple in syrup	1764	1.5	129	4	133
2.	Cubed pineapple in syrup sterile	1764	1.5	98	4	102
3.	Fruit Desert in syrup sterilised.	1764	1.5	64	2	66
4.	Pineapple Jam in jars	828	0.375	35	1	36
5.	Marmalade in jars	828	0.375	32	1	33
6.	Pineapple Juice natural	3,300	1.500	143	4	147
6a.	Pineapple Juice concentrated.	783	0.355	135	4	139
7.	Sugar syrup preparation	-	(0.9)	2	-	2
8.	Sterilisation : Cans - 1764 Jars - 828		(1.88)	2	-	2
9.	Reconditioning of flattened cans.	4100 cans	-	6	-	6
10.	Storage of ready products	5,892	3.37	12	1	13

...../

CONCLUSION:

The projected technology and machinery equipment enables to process simultaneously :

1. Sliced pineapple in syrup sterilised (and its modifications).

2. Pineapple juice natural and concentrated.

After the agronomical sphere in the region Rangamati will be more developed, the production period in the future can be for 5 or more months in a year extended.

Except this the production line No.1 is thus projected, so that it can be successfully used for the

Production of canned vegetable

in sour-sweet brine, in projected constellation, or if the line be equipped with pressure retorts, it can process canned vegetable in salt brine.

The production of jam and marmalade in regular quality is possible to spread out for all the year, when processing pineapple flesh preserved by H_2SO_3. (This should have been processed within the harvest period).

Except frozen and sterilised semiproducts most preserved fruit by H_2SO_3 will be used. (H_2SO_3 will be evaporated within the technological process).

The line No.3 can be used in the future for the production of tomato juice and puree.

Highest versatility and utilisation of the projected plant has been secured in this way.

..../

To increase the quality of concentrated juice, it is possible to complete the evaporator with fraction receiver. By this method aroma can be returned into the ready product.

To maintain the perfect quality of concentrated juice within storing, it is recommended to keep it in the cooling plant at the temperature + 10°C.

In order to provide this pre-feasibility study with most exact technical details were sent 20 letters to the most renowned producers of machinery equipment in all the world (see list of addresses communicated in the appendix) unfortunately only some answers came to the date, when this study was prepared.

As the characteristic of fruit may vary, it is recommended to prepare a technological proof trials with all kinds of fruits and vegetable. The most suitable for this trials would be the Division of Food Technology and Nutrition BCSIR Laboratories, Dacca.

This pre-feasibility study was started on 7 August 1978 and finished by 9th September 1978 (hand written).

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ANNEXES

Prospect of Pineapple Canning in Bangladesh

Discussion with Mr. Kamal Uddin Ahmed,
Project Director
Bangladesh Agricultural Research Institute

There was a discussion between Mr. Jiri V. Skala, UNDP Expert for Food Processing Industry attached to BSFIC and Mr. Kamaluddin Ahmed in latter's office on 3.8.78 at 10.00 a.m. Dr. A. Karim, Addl.Chief (Planning), BSFIC and the undersigned was also present.

In reply to a question Mr. K. U. Ahmed explained that there were three varieties of pineapples in Bangladesh.
These are:

1. Honey Queen
2. Giant Kew
3. Red Spanish (Ghorashal)

While Honey Queen and Giant Kew are mostly grown in Sylhet and Rangamati areas, Red Spanish grows in Ghorashal area in Dacca District. Now-a-days Giant Kew variety is also grown in Madhupur in Tangail District.

Mr. Ahmed mentioned that in Malayasia the Red Spanish variety is processed and canned particularly for two reasons: (1) the shape of this variety is more regular and loss as wastage is less, (2) the colour of this variety persists longer after canning. Of course, in Hawaii and Australia Giant Kew variety is mostly canned.

In Bangladesh the harvesting time of these three varieties is spread over 3/4 months (May to August) - Honey Queen, Giant Kew and Red Spanish respectively being the early mid and late varieties, of course, overlaping their periods of harvesting. That period of ripenning of pineapples may be controlled and prolonged by hormone treatment has been proved successful in other countries - like Malayasia, Australia and Hawaii. In Bangladesh too, research had been taken up in a limited scale on the effect of hormone (n-a-a and i-a-a) on pineapples in respect of prolonging the period of ripenning which is a pre-condition for establishing and running a pineapple processing industry economically. Mr. Ahmed told that there had not been an exhaustive research on pineapples as this fruit occupies a very negligible portion of the entire activities of the Bangladesh Agricultural Research Institute and the Bangladesh

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Horticulture Development Board is mainly busy with extension work rather than research. Mr. Ahmed was also of the openion that there should be a coordinated effort among the producers of pineapples, Government agencies like Ministry of Agriculture, Agricultural Research, Horticulture Board and the proposed processing industry i.e. BSFIC. They should work hand in hand so that production of pineapples and setting up the canning plant go simultaneously, otherwise one's lagging behind will retard the progress of the other. Therefore, it is proposed that vigorous research work which could not be undertaken so long due to paucity of fund and adequate man power, should be started immediately about the application of hormone on prolonging the harvesting period, agronomical practices on growth and quality of pineapples, etc to suit the climatic and soil conditions of Bangladesh. Dr. Ahmed pointed out that the sizes of plants and fruits should improve if proper doses of fertilizers were applied and more than one ratoon was discouraged. The producers of pineapples will surely be encouraged to apply imputs only if better products bring higher returns. Upto the present time the cultivators of Sylhet and Chittagong Hill Tracts have not got encouraging price for their produce. The prices of pineapples at producers' and consumers' levels are generally at 1:6 or 1:8 ratios, whereas it should not be more than 1:2 or at best 1:3 ratios.

Therefore, it is recommended that Bangladesh Sugar and Food Industries Corporation propose to the appropriate authority in the Government of Bangladesh to undertake an intensive research work on prolonging the ripenning period of pineapples and also on improving the quality of pineapples variety-wise with the assistance of international agencies like FAO/UNIDO. Otherwise, it is feared that investing money for establishing a canning industry without having the prospect of ensured supply of raw material at least through half the year may ultimately prove a sheer loss.

Again the cultivators will not feel encouraged to produce more if they do not find an ensured market for it. So, the entrepreneur must take the calculated risk of running the plant at much below the capacity (therefore at a loss) initially for 2/3 years.

The above points and the recommendation may be incorporated in the pre-feasibility study report on pineapple processing.

Mr. Jiri V. Skala
Food Industry Specialist.

(M. A. Islam)
Counterpart of U.N.D.P. Expert
4.8.78

LIST OF ADDRESSESS COMMUNICATED

Name of the Office	Date of Communication	Subject in brief
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 Duisburg, ATB. Benchiser - Wassertechnik Schriesheim German Federal Republic.	8.7.78	- do -
5. Tecator, Hogannas, S-263 01 P.O. 70 Sweeden.	11.7.78	Kjeldhe Analysis System I Macro, II Macro, III Macro.
6. Luwa 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. Box 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 Karilsruhe GMBH Ettlingena, 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 Kó, 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. Herbort, 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 Pfaudler 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.

13 October 1971

BANGLADESH OBSERVER

Demand for Bangladeshi products abroad

According to information received during the last week in the Export Promotion Bureau, there is a great demand for Bangladeshi products abroad, according to a PID handout.

The names of the countries and items of their interest are given below—

Australia:—Cotton dress for women. Canada: Spices preserved and canned fruits (like achar chatni) handicrafts; Italy: Handicrafts; Iran: Leather viscose rayon varn jute wood: wood products chipboard enamelled wires ACSR conductors volt meters wooden poles for electric lines, canned fruits; canned fish bicycle tubes: black tea telephone G.I Pipes news print: printing papers vegetables jute twine and varn jute film hessian cloth runner bags Kenya: Plastic cups of various sizes for dairy farms Nigeria: Paints and varnishes hats and caps: hurricane lanterns telegraphic rails, leather belts: Nepal: Fish (prawn bhekti hilsha) Pakistan: Turmaric kathas velvets buttons. Sri Lanka, Jute twine: jute hessian.

Interested parties are requested to contact the Export Promotion Bureau at [illegible] Chittagong: Khulna and Rajshahi for details materials [illegible] buy etc.