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SUGAR INDUSTRY OF PAKISTAN

by

K. Mushtaq Ilahi

Pakistan Institute of Development Economics
Post Box **No.** 1091, **Islamabad**
(Pakistan)

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FOREWARD

With the advancement of agricultural development processing of agricultural products assumes a special importance. The cultivation of sugarcane and the manufacture of sugar, gur and shakkar are important economic activities in Pakistan. Despite their importance, very little attention has been paid to a comprehensive analysis of cane production and its processing. This study presents an overall view of the different issues involved in cane production, cane procurement, sugar manufacturing, gur and shakkar making, location of sugar mills and the possibilities of exports of sugar from Pakistan.

Keeping in view the limitations of data and the very broad scope that the author had delineated, this study is a useful starting point for any future research worker in this area. K. Mushtaq Ilahi the author of the present study, has had a varied and long experience of financing the establishment of sugar mills in Pakistan when he was a member of the senior management of Pakistan Industrial Credit & Investment Corporation (PICIC) and had also acted as a Director of some of the sugar mills financed by that organization. Based on his long experience in financing and management of sugar mills, the author has discussed most policy issues and various options open for the policy-maker in a competent manner. This study should be of immense value to both research workers and policymakers interested in the subject.

(M.L. QURESHI)
Director

PREFACE

For the use of some of their views and statistics, I gratefully acknowledge my debt to the 1973 Mission to Pakistan by the Food and Agricultural Organization and to the Board of Economic Enquiry, Lahore. I must also express my professional appreciation to the Pakistan Society of Sugar Technologists, Crescent Sugar Mills at Faisalabad, Habib Sugar Mills at Nawabshah, Hyeson Sugar Mills at Khanpur for providing the required data readily and willingly. I am also grateful to the different Government Organizations and agricultural research institute for giving me access to the information available with them. In particular, I would like to thank heartily, Mr. Asghar Qureshi, the able General Manager of Cresent Sugar Mills, Faisalabad for the time that he so kindly spared for detailed discussions with me on the subject of production and pricing of sugar. I cannot but place on record my grateful thanks to Mr. Shahab-ud-Deen Fasihi, the Sugar cane Botanist at the Agricultural Research Institute, Faisalabad and his staff for their whore-hearted cooperation and fullest possible assistance given to me in the completion of this "Study". Lastly, I must thank the Pakistan Institute of Development Economics for generous financial support for the study.

K. MUSHTAQ ILAHI

CONVERSION TABLES

1 maund	=	82.286 lb.	=	37.324 kg.
1 long ton	=	1.016 metric ton	=	27.22 maunds.
1 acre	=	4,840 square yards	=	0.4047 hectare.
1 U.S. $	=	Rupees 9.90		
1 Sterling	=	Rupees 17.00		
1 Crore	=	10,000,000/-		
1 Lac	=	100,000/-		

CHAPTER - 1

INTRODUCTORY

The sugar industry is one of the most important industries of Pakistan. Sugarcane, which is the main base of the industry is widely grown in the country. In fact it now occupies more than 1.6 million acres every year that is, about 10% of irrigated land under kharif crops in Pakistan. Internationally Pakistan is the fourth largest producer of sugarcane. There were twenty five (25) sugar mills working in the country (1975-76) with a fixed investment of over Rs.100/- crores and an equity capital of Rs.60 crores approximately. Two more sugar mills have gone into trial production during the cane crushing season of 1976-77; one at Khazzana (Peshawar Division) and the other at Ranipur (Khairpur Division). Ten sugar mills have been ordered in the Public Sector and five are in the various stages of planning in the private sector. With their completion, the total investment in fixed assets should exceed Rs.500 crores. The 25 sugar mills in commercial production are already contributing to the national exchequer about Rs.50 crores per year as central excise duty. The Provisional Governments are earning an amount of Rs.55 crores every year as margin on sales of sugar. Cane cess provided another Rs.3.8 crores every year for construction of roads linking the main areas of supply of cane with the sugar mills. These roads facilitate not only the transportation of sugar cane to the mills but also enable the growers to easily transport their other produce to the mandis at reduced costs. Besides the Muncipal Committees realize a sizeable amount by way of taxes from sugar mills without providing any amenities to the mills or the growers. This is perhaps

the only industry in Pakistan which has been trying to help itself, though on a limited scale in solving the basic problems which have been retarding its growth. The sugar mills are progressively organizing advances of loans both in kind and cash out of their own resources or on their surety from banks to the growers of sugar crops for purchase of seeds, fertilizers, tractors and other implements and even for installation of tubewells. Many of the sugar mills undertake experimental work on farmers' lands or their own experimental farms for selection and multiplication of suitable varieties of sugar cane developed in the research stations of Agriculture Departments. Almost every mill has its own extension service though the extent of advice and assistance provided by it to the growers varies from mill to mill and may be negligible in most cases. However, a nucleus for developing such a service in an effective manner has already been created by almost every mill. The sugar industry has a well organised "Pakistan Society of Sugar Technologists" which provides a forum, once in almost every year, for exchange of views between technicians engaged in the various aspects of the sugar industry, e.g. botanists, agronomists, chemists, engineers, managers. Besides, that Society has taken upon itself the task of collecting detailed data from all the sugar mills and compilling it for monthly and annual circulation among all those who may be interested in such statistics. The F.A.O. Commodity Mission which carried out a study of the sugar industry of Pakistan in 1973-74 have stated that the standard of technological work in sugar mills "is comparable with that of any other cane area in the world".

2. Inspite of what is stated above it cannot be said that everything is alright with this industry. Far from that! The industry is faced with

many acute and fundamental problems. The economics of sugar in Pakistan is much more complicated than that of other countries, except perhaps India, because of the existance of a large sized cottage industry competing with the mills. Products of the cottage industry are by far the main source of sugar consumed in the country, especially in the rural areas. This source is, however, very wasteful in that it throws down the drain not less than 3% of sugar contained in the cane crushed by it. It is a fully established fact that if white sugar were to become more freely available at reasonable and stable prices the demand for mill made sugar will grow very fast. The total demand for sugar, in any case is rising in the country mainly because of increasing population and incomes. Being the fourth largest producer of sugar-cane in the world, Pakistan should be seriously concerned with having an annual surplus of exportable sugar to improve its balance of payment position. To be competitive in the export market, manufacture of more and more bye products of sugar industry also demand attention. But, perhaps the most important problem facing this industry is that the present milling capacity has not been able to cope with the rising demand of white sugar in many years in the past because even the existing capacity has not been fully utilized year after year for want of adequate supply of sugarcane. This can be attributed to a number of reasons, including Government policies. If the demand for white sugar is to be met locally, supplies of cane to the mills will have to be increased. At present Pakistan's per acre yield and sugar content of cane, on average, are almost the lowest in the world. There has been almost no growth or improvement in cane yields per acre or recoveries of sugar from the cane since the end of Sixties. Increase in supply of cane can be achieved either by increasing acreage

under sugarcane or by introducing such varieties of sugarcane in the fields as can give better yields of sugar per acre and by following modern scientific methods of raising and harvesting the crop. More acreage means more demand for scarce water. Higher yields demand greater efforts in all directions, besides need time. Alternatively sugar may have to be imported from abroad. After all sugar is now an essential part of every man's food. It is now considered to be a basic commodity. It is also a more efficient source of calories for the consumer. Prof. Stare of Harvard University of U.S.A. that "one hectare of sugarcane or beet produces approximately 15 million calories, potatoes produce 5.0 million calories, corn or wheat about 2.5 million, milk less than 1.0 million and beef less than 0.25 million calories per hectare". Since sugar alone cannot provide a complete and balanced diet for human begins and other items of food have also to be grown on the cultivable land, an appropriate level of land utilization under sugarcane etc. will have to be worked out to derive optimum benefit from the available inputs e.g. land, water, fertilizers. The country has to decide how far it can afford to allow increase in the production of sugar cane and how best it can meet the demand of sugar in the country.

3. It is felt that the above-mentioned problems are of fundamental importance to the economics of sugar industry of Pakistan and were deserving of greater attention than has been given to it in the past by the various agencies entrusted with the responsibility of developing the industry on healthy economic lines. It is for this reason that the most successful producers of sugar operate on the basis of sugar plantations which have full control of the acreage used for the production of sugar-cane as well as of the mills for which the cane is grown. The economics of sugar production

cannot be properly examined unless the production of sugar cane in the field is also studied in details It is accordingly proposed to deal in this "Study" first with the production and economics of sugar yielding crops and then the economics of manufacture of sugar with a view to finding appropriate answers to the questions posed above, for the benefit of those who are concerned in any capacity with decision making regarding this industry.

CHAPTER - II

SUGAR-CANE

The acreage and production of sugar cane in the various Divisions of Pakistan and the rate at which these fluctuated since independence are given in Tables I and II.

These tables show that the acreage and production of sugar cane in Pakistan has been marked by wide fluctuations. The acreage almost doubled during the Fifties, but the rate of increase averaged to less than 50% during the Sixties. During the beginning of the Seventies the acreage had gone down, though it has again shown improvement during the past three years.

The province of the Punjab has been producing the bulk of the sugar cane in Pakistan. There has been significant increase in the total acreage under cane in Sind, which is climatically the most suitable area in Pakistan for this crop. It increased almost ten times by 1970, but since then the rate of growth has been very slow. The same trend has occurred in the Punjab and the NWFP. However, the Punjab still accounts for nearly 70% of the total area under cane, as against the NWFP and Sind each contributing half of the remainder i.e. 14-15% each.

Increase in the quantum of cane production has been achieved largely by increase in acreage. Table II also compares the rate of increase in the acreage of sugar cane and those of other principal crops, namely wheat, rice and cotton. It will be seen that during the past quarter of a century the area under sugar cane has expanded far more rapidly than areas under other major crops. Taking the average of 1947-50 as the base, it is seen that sugar cane area increased by about 246% by 1975-76. As against this, cotton area increased by only 63%, rice area by about 97% and wheat area by about 55%.

Production=000 tons
Area=000 acres
Yield= Maunds

TABLE - I

AREA AND YIELD PER ACRE OF SUGAR CANE IN DIFFERENT DIVISIONS OF PAKISTAN

(averages per year)

	1947-50	1951-55	1956-60	1961-65	1966-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
PAKISTAN											
Area	499.00	606.80	903.00	1158.20	1439.00	1572.00	1365.00	1318.00	1564.00	1663.00	1729.00
Yield	356.7	317.00	313.02	365.11	366.65	394.90	391.9	405.3	409.5	342.3	396.00
Total Annual Production	6526.31	7067.40	10382.26	15532.48	19080.61	22801.00	19648.00	19632.00	23533.00	20901.00	25141.00
N.W.F.P. Province											
Area	110.7	111.2	150.9	169.4	202.0	199.5	211.9	215.1	222.0	231.6	233.2
Yield	304.30	300.0	325.2	381.3	426.8	415.3	430.1	411.5	422.0	483.7	424.2
Peshawar Division											
Area	107.6	107.0	139.8	156.0	180.0	163.3	176.3	173.6	180.0	189.2	188.8
Yield/acre	305.13	309.76	342.75	401.11	401.15	431.4	448.3	433.2	443.1	443.0	442.5
Malakand Division											
Area	--	--	--	--	--	9.0	9.0	10.5	12.0	12.6	13.6
Yield/acre	--	--	--	--	--	387.4	396.2	400.3	391.0	393.8	387.3
D.I.Khan Division											
Area	3.1	4.2	11.1	13.4	22.0	27.2	26.6	31.0	30.0	29.8	30.8
Yield/acre	224.37	22.42	242.53	264.73	263.35	327.4	320.3	293.5	307.0	313.9	326.7
PUNJAB Province											
Area	369.0	474.0	708.2	877.6	1057.0	1076.0	966.0	908.0	1091.0	1172.0	1235.0
Yield/acre	380.0	315.2	291.5	347.1	410.0	353.5	382.0	405.0	408.1	338.5	396.3

	1947-50	1951-55	1956-60	1961-65	1966-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
RAWALPINDI Division											
Area	18.0	20.2	27.4	35.0	49.0	65.0	61.0	58.0	75.0	76.0	79.0
Yield/acre	415.58	301.70	276.5	323.90	297.90	322.9	317.3	322.4	365.8	311.6	366.3
SARGODHA Division											
Area	103.0	156.3	238.7	299.9	323.0	470.0	405.0	392.0	441.0	473.0	487.0
Yield/acre	436.98	334.34	318.47	394.61	403.73	469.6	437.2	467.1	459.0	379.3	439.6
LAHORE Division											
Area	121.3	145.1	167.4	198.1	209.0	196.0	168.0	143.0	175.0	202.0	207.0
Yield/acre	367.01	170.45	258.26	282.64	273.53	361.1	361.1	389.8	410.0	333.4	405.8
MULTAN Division											
Area	75.9	93.8	166.5	187.0	288.0	240.0	203.0	196.0	234.0	247.0	271.0
Yield/acre	394.05	303.06	354.13	367.51	380.69	309.1	308.9	352.7	374.7	299.9	370.0
BAHAWALPUR Division											
Area	50.8	50.4	108.2	157.6	188.0	205.0	129.0	119.0	163.0	174.0	191.0
Yield/acre	256.69	360.77	296.30	345.09	340.77	313.9	318.8	345.2	335.5	300.4	325.1
SIND Province											
Area	19.3	31.6	43.9	111.2	130.0	195.8	186.6	195.1	215.3	258.9	260.9
Yield/acre	333.3	432.80	432.8	436.70	431.6	443.2	399.8	400.3	404.6	286.3	368.3
KHAIRPUR Division											
Area	7.9	12.4	25.4	53.7	69.0	66.7	68.7	75.7	89.3	84.0	90.1
Yield/acre	353.99	432.65	429.75	414.77	381.49	404.5	370.8	374.7	374.1	283.2	362.6

...../P-

		1947-50	1951-55	1956-60	1961-65	1966-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
HYDERABAD Division	Area	11.4	9.2	18.4	57.5	111.0	129.1	117.9	119.4	126.0	174.9	170.0
	Yield/acre	325.19	463.28	484.68	454.19	405.87	463.2	476.7	416.5	421.2	287.8	371.2
KARACHI Division	Area	-	-	-	-	-	-	-	-	-	-	-
	Yield/acre	-	-	-	-	-	-	-	-	-	-	-

SOURCES:

i) Appendix VII, Page 124 of F.A.O. Report No.TA-3257 of 1974

ii) Page 34 of Pakistan Statistical Year Book 1975

iii) Table VI of proceedings of the 11th Convention of the Pakistan Society of Sugar Technologists, 1974, up-dated by the records of the Secretariat of the Society.

TABLE - II

AREA UNDER IMPORTANT CROPS IN PAKISTAN

(Area in 000 acres)

CROP	1947-50	1951-55	1956-60	1961-65	1966-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
Sugar-cane:											
Area	499	907	903	1159	1417	1571	1364	1318	1565	1663	1729
% increase		82	81	132	194	215	173	164	214	233	246
Cotton:											
Area	2799	3152	3442	3459	4178	4284	4837	4967	4559	5019	4576
% increase		13	23	24	49	53	73	77	63	79	63
Wheat:											
Area	9770	10265	11627	12316	14208	14771	14325	14754	15105	14363	15191
% increase		5	12	26	45	51	47	57	55	47	55
Rice:											
Area	2110	2340	2653	3075	3656	3715	3599	3656	3736	3964	4149
% increase		11	26	45	73	76	71	73	77	88	97

Sources: Pakistan Statistical Year Book 1975 - pp. 32-34 and earlier editions

% increase calculated on the basis of 1947-1950

The Table III below compares the average yields per acre of sugar cane obtained in Pakistan with the average yields in other sugar producing countries of the World.

Table - III

Yield Per Acre of Sugar Cane in Some Sugar Cane Producing Countries

Name of Country	Production Per Acre (Long Tons)		Months Taken For Crop to Mature	National Average of Sugar Content Per Acre (in Tons)
	1974	1975		
India	20.71	20.48	12-18	1.98
Brazil	19.84	17.59	15-18	-
Cuba	14.16	14.43	18-20	2.40
Pakistan	15.29	12.77	10-12	1.275
Mexico	27.25	26.43	14-10	-
Phillipines	21.05	19.31	12-15	-
Indonesia	32.98	32.16	12-15	-
U. S. A.	30.67	33.43	12-15	-
South Africa	32.77	35.36	16-18	-
Australia	32.59	32.97	15-18	3.38

Source: [Page 190-F.A.O. Production Year Book 1975, Vol. 29].

The figures given in Tables I and III show that Pakistan's national average of sugar cane per acre works out to about 15 long tons and sugar per acre may be around 1.275 tons. These are the lowest productivity figures in the world. But it should also be observed from Table III above than the sugar cane crop in Pakistan is harvested in 10-12 months as against 16-24

months allowed by other countries. However, outstanding yields are even now being obtained in some fields in Pakistan by proper application of modern techniques and practices. It is not uncommon to see samples of sizeable blocks of sugar cane having an average yield per acre of 30 to 40 tons year after year. There are even fields managed by progressive farmers yielding as much as 30 to 60 tons of cane per acre over long periods of time. The farms of the Agriculture Departments invariably yield much higher tonnage per acre than the national average of a particular year. The yields of the sugar farm of Fauji Foundation attached to their mill at Tando Mohammad Khan are also very impressive. It is obvious that Pakistan has the potential that can permit a considerably higher national per acre yield of sugar cane as well as sugar.

There is a period in the life of every crop when its true seed has to be replaced by new varieties. This is all the more necessary in the case of sugar cane. It takes approximately ten years from growing hybrid cane from true seed, selection of varieties and finally distributing the proven varieties to the farmers. This aspect of an essential activity in the development of sugar cane crop seems to have received very little attention in the past. The extension services of the Agriculture Departments do not as yet appear to be well equipped with staff and resources and have failed to create an impact on the farmers in the case of sugar cane crop.

The research facilities for the development of new varieties of sugar cane may be costing at present less than Rs. 15 lacs to the Government and about Rs. 20 lacs to the mills, excluding the credit given to the farmers. This is an absolutely insignificant figure and hardly worth even mentioning when compared to the budget of research facilities available in other sugar producing countries. It is emphasized that the existing research and

extension facilities are inadequate to serve the requirements of the sugar industry. The staff available for research and extension work are also inadequate.

Under the conditions described above, it is but natural that yields and quality of sugar cane in Pakistan should be almost the poorest in the world. Scarcity of irrigation water does not allow of any large increase in Pakistan's acreage of sugar cane at economic cost.

Pakistan Sugar Commission of 1957-59, the Agricultural Enquiry Committee 1974 as well as the F.A.O. Commodity Policy Study on Sugar of 1973-74 have recommended the establishment of an autbnomous National Sugar Cane Institute/Committee devoted solely to the sugar crops. It is high time that such an institute should be set up and made to work effectively. It is understood that Provincial Governments have started organising their own separate institutes. It does not seem to be desireable that a poor country like Pakistan should spare the resources required to run three efficient institutes instead of one which should have a sub-station in the cane zone of every mill for carrying on various kinds of experiments on selected varieties of cane under local conditions and propagating the "approved" varieties and educating the farmers and supervising their operations in the fields.

ECONOMICS OF SUGAR CANE CROP

Annexure I to VI contain calculations of cost of production of major Pakistani crops - sugar-cane, cotton, wheat and rice, as worked out in 1975-76 by the cane botanist of Agricultural Research Institute at Lyallpur. Net return per acre to the farmer from these crops on the basis of calculations of Annexures I to VI, are compared in Table IV below:

Table IV

Net Return per acre per year from major crops

Crop	Net return per acre Rs.	Duration of crop Month	Income from a possible second crop Rs.	Total Annual Income Rs.	Remarks
Sugarcane (Plant)	297.35	12	Nil	297.35	Average for 2 years is Rs. 477.79 p.a.
Sugarcane (Ratoon)	658.24	12	Nil	658.24	
Cotton	78.37	5-7	201.36	279.73	
Wheat	201.36	5-7	78.37	279.73	
Rice (Irri-6)	140.98	5-6	201.36	342.34	
Rice (Basmati)	94.20	5-6	201.36 (Wheat)	295.56	

The figures of Table IV above have been arrived at on the basis of the following assumptions:

Crop	Yields per acre (Maunds)	Price per Maund (Rs.)	Water Rate (Rs.)	Fertilizer Used Chemical/FYM Bags	Carts
				Urea	
Sugarcane (Plant)	450	5.75	35.	1	10
Sugarcane (Ratoon)	325	5.75	35	1	Nil
Cotton	10	85.00 (seed cotton)	16	½ + DAP 1 bag	Nil
Wheat	20	37.00	10.60	1	Nil
Rice (Irri-6)	30	27.00	16.00	½ + DAP 1 bag	Nil
Rice (Basmati)	18	45.00	16.86	1 + -do-	Nil

These calculations show that in Pakistan sugar cane is generally the most paying crop for the grower even as against income from two crops, like cotton plus wheat in a year from the same field (one acre). Annexures I to VI and Table IV also show that income per acre is about Rs. 480. This income is computed after taking into account the rent of land, the cost of labour etc. which may have been provided by the growers' family wholly or in part. This conclusion cannot convince those who are used to hearing from the farmers that they earn Rs.2000/- or so per acre from sugar cane and similarly much more impressive figures than shown by calculations of Annexure III to VI in the case of cotton, rice and wheat. The Government of Sind, department of Agriculture, uses very different figures for cost of production of those crops. Those are shown in Annexure VII. According to those calculations, sugar cane yields a net income of Rs. 1007.50 per acre, cotton gives Rs. 782.50 and wheat yields Rs. 433.00 per acre. However, the calculations of Sind Government also lead to the conclusion that sugar cane is the most paying crop, given the required inputs.

The Board of Economic Enquiry Punjab, in their Publication No. 148, published in 1971, summarised the income per acre from sugar cane crop as under:

Table V

Income Per Acre from Sugar Cane Crop

	Income (Rs.)
(a) By converting entire crop into:	
(1) Gur	875.00
(2) Desi Sugar	738.00
(b) By selling entire crop to:	
(1) White Sugar Mills	1035.00
(2) Khandsazi Factories	725.00
(c) By utilizing entire crop according to crop disposal pattern:	
(1) Overall	844.00
(2) Zone Area	942.00

Source: / Page 136 Board of Ec. Enquiry Punjab, Publication No. 148 /.

These figures were worked out on the basis of a sample survey carried out in 1970 when price of cane payable by the sugar mill was fixed Rs.2.50,2.75 and 2.90 per maund in Northern, Central and Southern regions respectively.

The above table V shows, inter alia, that of all the possible alternatives available to a grower, sale of cane to sugar mills at the prices mentioned above was the most attractive one.

An attempt has been made in Annexure VIII to work out a more realistic return from sugar cane by deviating from the assumptions made in Annexure I to VII, wherever necessary, and by explaining the deviations in the "Remarks" column. For example, it has been assumed that the yield of cane per acre would be 25 tons or 680 maunds as against 475 maunds assumed in Annexure I and 700 maunds in Annexure VII. Already the national average is around 408 maunds. It is agreed by experts that better ploughing and preparation of the land, use of better quality scientifically treated cane seed, and application of plant protection measures, for which provision has been made in the calculations, should increase theyield by 15%, 10-15% and 10-15% respectively. Thus an overall increase of over 35% should be expected from these measures. Then the application of fertilizers in the dozes provided for in the calculations should bring up the yield by another 33% or so. Ignoring the effects of other measures recommended later in this 'study' for which the cost has been provided for in Annexure VIII, it appears reasonable to assume that yield of cane per acre will go up to 680 maunds (25 tons) or say by 66%. It may be pointed out here again that yields higher than 680 maunds are already being obtained in the fields of many growers especially those in the mill zones, and the Government of Sind have assumed a yield of 700 maunds per acre as shown in Annexure VII. As such, it does not seem to be

prudent to agree with the assumption of Annexure I that the per acre yield will go up in the case sorghum from the present National average of 408 maunds (for total acreage) to 475 maunds only, after all the inputs recommended by the scientists have been provided for.

Another item of calculation to which attention may be drawn is the element of subsidy by the Government to the grower in respect of irrigation, fertilizers, plant protection, etc. The cost of a grower in respect of all crops is subsidised to some extent by the Government, and as such the economic cost per unit of every crop to the Nation as a whole must be somewhat higher than the figures worked out in Annexures I to VIII.

As regards Irrigation Rates, it will be observed from Annexures I to VII that the charges for the various crops are as under:

Table VI

Current Irrigation Charges for Plant & Ratoon Crops

Crop	Number of Irrigations	Charges included in calculations (Ann. I to VIII) PUNJAB Water rate+labour = Total	SIND (includes labour)
		Rs.	
1. Sugarcane	16/17	35.0 +48 = 83.00	70.00
2. Cotton	8	16.0 +32.00 = 32.00	28.00
3. Wheat	5	10.0 +14.0 = 24.60	14.00
4. Rice (IRRI)	16	16.0 +40.0 = 56.00	

Irrigation rates have been revised by the Government from time to time in order to bring them in line with the rising costs of maintenance, depreciation, etc. of irrigation works. It is understood that these rates have been increased four times since 1959 and the last increase was enforced in the year 1969. It is further understood that each time the increase has been of the

order of 10-15% over the previous schedule of rates. It is, however, doubtful if the rates of 1969 reflect fully the expenses incurred by the Government on account of Indus Basin works i.e. construction and depreciation/replacement costs of Mangla and Tarbela dams, Link canals, tube wells built to pump out the water seeping down the gigantic irrigation works etc. It would obviously need a separate comprehensive "study" to establish the extent of subsidy in the current irrigation rates. For the purpose of this "study", it is proposed that to calculate the National cost of sugarcane, the irrigation expenses should be presumed to be of the order of Rs. 100.00 per acre by arbitrarily raising the present charges in the Punjab by Rs. 17.00 per acre, and in Sind by Rs. 30.00 per acre.

In respect of Chemical Fertilizers, the present day subsidy, which is provided wholly by the Central Government, is shown in the Revised Budget Estimates for the year 1975-76 to be Rs. 60.65 crores as against Rs. 43.13* shown in the budget estimates.

If the cropped area of the country during that year is roughly estimated at 45 million acres and it is presumed that only one-tenth of that acreage actually used the fertilizers, the subsidy works out to Rs.25.00 per acre. For the entire sugar cane crop the national cost of production per acre may be increased by say Rs. 30.00 approximately on account of subsidy on fertilizers since this crop is one of the major consumers of fertilizers.

Now let us consider the subsidy on account of Plant Protection measures. Crops are being aerially sprayed by the Plant Protection Department of the Government of Pakistan free of cost. In 1975-76, that department was to cover an acreage of 28 lacs approximately at an averge opertional

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* See page 26 of the Budget in Brief 1976-77, Finance Division, Government of Pakistan.

cost of Rs. 392 per acre, including the desert areas covered for locust etc. The cost of spraying the crops was worked out by the department to be Rs.42.00 per spray acre of cotton, Rs. 29.00 per spray acres of paddy and Rs. 27.00 per spray acre of sugar cane. The entire cane crop of the NWFP and less than one lac acres of sugar cane or say a total of 300,000 acres of sugar cane in Sind are generally sprayed in a year at an expense of Rs. 60.00 per acre approximately to the Federal Government. (Ordinarily only 2 sprayings are done in the N.W.F.P. and three in Sind for sugar cane).

The Provincial Governments maintain departments of Plant Protection which provide spray facilities on the ground but charge the growers 50% of the cost of pesticides. The Provincial Governments' operational cost is estimated at Rs. 12.00 per acre. They also sell pesticides to the growers at 50% of their cost. The supply is free of custom/excise duty. Private firms undertake spraying from the air or even on the ground under contracts with the Central/Provincial Governments but have little business to do so far as private farms are concerned.

Thus the local sugar cane crop receives a total subsidy of Rs. 22,800,000 on account of Governmental spraying operations, presuming that half the acreage in the Punjab gets the benefits of those operations at two-third of the cost. Adding Rs. 1200,000.00 as subsidy for pesticides sold to the growers for self spraying, and spreading the entire subsidy over the total cane area of the mill zones, the subsidy on account of Plant Protection measures works out to Rs. 45,00 per acre approximately.

As a result of the above calculations it would appear necessary to add Rs. 92.00 per acre to the growers' cost of production to obtain the national economic cost of growing sugar cane. Reflecting this figure in the calculations of Annexure VIII, the national/economic cost of production of sugar cane works out to about Rs. 4.25 per maund as against Rs. 4.12 being

the cost of production of the grower in the Punjab. The Government of Sind have worked out (see Annexure VII) grower's cost of production at Rs.4.05 per maund. National cost in Sind may also be presumed to be Rs.4.25 per maund.

The present day minimum prices at which the mills are legally bound to purchase their requirements of cane are Rs.5.50, 5.75 and 5.90 per maund in the Northern, Central and Southern Regions as shown in Table VII. These figures obviously provide a handsome margin of profit to the grower.

It has been stated earlier that the growers have been increasing the acreage under sugar cane at much higher rates than that of other major crops. Table IV shows that the farmer's decision is largely based on financial considerations. The outstanding financial benefits of cane growing are further established by the prosperity which has come to the areas where sugar mills have been installed.

Besides financial returns, sugar cane cultivation has other attractions for the grower which are mainly of an economic character. Firstly, this crop generally supplies him about 20 to 25% of the weight of sugar cane produced in a field for fooder. After crushing his cane for gur, the farmer is left with bagasse and molasses. With 10 acres of cane farming the farmer gets about 1020 maunds (15%) of dry baggasse, which he uses mainly as a fuel. In addition, the grower will get about 349 maunds (5%) of molasses, which he can sell for an average price of Rs.1500/- (at the prevailing price of 1976. In the case of other crops, the additional returns from by-products cannot be so paying.

The best and the biggest organised buyer of cane in Pakistan as in other countries is the sugar mill nearest to the grower's field. As shown in Table V earlier, supply of cane to sugar mill is the most profitable disposal of the crop. The prices paid by the mills have been controlled by the Government. The following Table VII below shows the minimum prices that have been paid in the recent past to the growers in accordance with the orders of the Government.

Table VII

Minimum Prices of Cane Payable by Sugar Mills in Pakistan

Year	Price per maund at factory rate (Rs.) N.W.F.P.	Punjab	Sind
1969-70	2.75	2.75	2.90
1970-71	2.76	2.75	2.90
1971-72	2.75	2.50	2.65
1972-73	* 3.10	(1) 3.35	(1) 3.50
1973-74	(2) * 4.00	(2) 4.25	(2) 4.40
1974-75	5.50	4.35	4.40
1975-76	5.50	5.75	5.90
1976-77	5.50	5.75	5.90

(1) (2) * (Prices were raised during the season)

Source: i) Food Department, Government of Pakistan.

ii) F.A.O. Report No. TA 3257 - Page 69 up-dated.

It would have been useful to have a detailed comparison of the cost of production of sugar cane in Pakistan with that of other countries. Such a comparison is however difficult to make for lack of comparable data of other countries. The facts and statistics given earlier prominently bring forth the following facts about the sugar cane crop of Pakistan:-

(i) the yield per acre both in terms of weight of cane and sugar content are almost the lowest in the World.

(ii) the grower in Pakistan gets the best return from his land by producing sugar cane as against any other crop.

It is also argued that, even with the existing resource of water and land under cane cultivation, the grower and the country can obtain significantly higher yields on application of developed techniques and that such efforts can begin bearing fruit from within a couple of years of

the use of better techniques.

A lot of discussion and debate seems to have been going on in the country as to what is immediately required to be done to raise sugar yield per acre. A number of agricultural experts, both local and foreign, have given their reports on the subject. All agree that unless the price of cane supplied to the mills is linked with its recovery of sugar and specialised cane extension service is provided, there will be no serious effort on the part of the grower to cultivate cane of high sugar content variation, to follow modern methods of cultivation and deliver the cane to the factory in fresh condition. There is, however, persistent disagreement in Pakistan as to how to get the needful done by the growers. The ideal solution is recognised to be sampling of all deliveries at the mill gate and paying for each delivery to the grower on the basis of the sugar content. This is an extremely difficult condition to fulfil especially in Pakistan. Whatever system is adopted for this purpose, it can work only if it is acceptable to both the growers and the mills on the basis of mutual trust. However, the debate as to which is the best system of linking the price of cane to its sugar content under conditions prevailing in Pakistan is likely to continue unless it is resolved at the higher level. Pending a more scientific solution of that problem, it seems to be the concensus of opinion that the mills should help themselves by helping the growers in obtaining better yields and for that purpose partly invest in technical manpower for extension work and also ensure availability of credit at the right time, in cash or in kind, directly or indirectly, for inputs and then organise harvesting of the crop and its transport in accordance with a well planned schedule of deliveries at the mill gate.[1])

It is heartening to note that the mill owners may not be opposed to the enlargement of their Cane Departments to perform the proposed functions.

[1]) For a more detailed discussion of this issue, see chapter V of this study.

Perhaps the following paragraph in the speech of Mr. Asghar Qureshi, the General Manager of Crescent Sugar Mills, Faisalabad as President of "Pakistan Society of Sugar Technologists" held at Karachi on September 12, 1974 reflects the view of the mill owners.

"Another potential which can be exploited to ensure adequate supplies to the factory is the increase of yield per acre. Our average yields are far too low and there is great scope to increase these. Apart from the introduction of high yielding varieties which is a time consuming process, yields can be improved by better cultural practices, optimum fertilizers, adequate provision of irrigation water and proper plant protection measures. Mills themselves can do a lot in this. Each mill should have a strong cane or beet development department to advise the growers in improved methods of cultivation. The mills should arrange large numbers of demonstration plots where beneficial effects of all the improved techniques of cropping should be demonstrated to the growers. The cultivation of the land at the moment is very poor. It may not be a bad idea for the mills to own a certain number of tractors and proper cultivation equipment and to do the first one or two ploughing on the small farmers' fields on the basis of no loss no profit. Better and deep cultivation alone can become a big factor in increasing the crop yields. Fertilizers should be supplied to the growers on credit at the right time. Help should be arranged for plant protection measures for the growers. In this connection it may be biological plant protection measures. It is also worth considering by the Government as to how the irrigation supplies can be stabilized in the sugar cane growing areas. All these factors can go a long way in immediately increasing the production of sugar cane".

CHAPTER - III

SUGAR-BEET

About one-third of World supply of white sugar is being made from sugar beet. This crop grows largely in sub-tropical areas of upper latitudesand in cooler climates. However, countries which fall on the border line, like Iran, China and Pakistan can also grow some sugar beet ---------- as they can grow sugar cane even though they are not part of the tropics. The entire production of white sugar of countries like the USSR, France, West Germany, Poland, Czechoslovakia, Holland, Spain and Turkey depends on sugar-beet.

In Pakistan, the sugar cane specialists at Mardan have been conducting experiments since 1952 and have established that sugar beet can be successfully grown in the north western districts. Charsaddah Tehsil in Peshawar Division is the most prominent area for this purpose.

Since 1958, this crop has been sown on a commercial scale with the help of seeds imported from foreign countries, mainly West Germany. Experiments to produce beet seed at Parachinar have been carried out not without success. This is a highly specialised subject and Pakistan will have to depend upon imports of such seeds for many more years to come.

Growing of sugar beet offers quite a few attractions. It is sown in the middle of September to the end of October, and harvested in May and June. Thus it is a crop of 8-9 months (as against sugar cane, which occupies the field for the whole year) and the same land can be used for raising another crop of say, maize. Secondly, sugar beet requires less water then sugar cane. The sugar beet yields 10-11 per cent sugar in Pakistan as against its national average of 8.6% in case of sugar-cane. Sugar beet crop is not affected by frost like sugar cane and is, therefore, admirably suited for Pakistan's Northern and North-Western districts. To ensure economically sound

operations sugar mills based on sugar cane have to stop crushing in the end of April and that is the time when sugar beet crop is ready for harvesting. The crushing season of the sugar mills, located in areas where sugar beet can be successfully grown can thus be increased by about 45 days every year with an additional investment of a small percentage of the total cost of a new sugar mill. That would add to the total production of sugar in the country, and reduce the cost of production of the mills which can use both sugar cane and beet. Lastly, leaves and crowns of sugar beet are used as fresh fodder and its pulp can be a good base for a cattle feed industry.

There are a number of limiting factors to the expansion of sugar beet crop. Firstly, the climate can allow its growth only in the northern districts of Pakistan and as such only the mills located in these districts can take advantage of it. Such areas cannot accomodate more sugar mills because sugar cane is badly effected by severe cold of northern areas. The mills alone can offer a market for sugar beet crop as this crop cannot be used, like sugar cane, by the cottage industry. At present, only three mills with a crushing capacity of about 5000 tons per day are in the market. Khazana sugar mills may also start operating on sugar beet and raise the demand by 2150 tons per day or about 100,000 tons per season. Another limiting factor is the availability of manual labour which is required for this crop on a larger scale than sugar cane.

The rapid expansion of the sugar beet crop, as is evidenced by Table VIII below, shows that the crop is profitable to the growers. The price per maund of beet is higher than that of sugar cane and so is the yield per acre.

Table VIII

Production of Sugar Beet and Sugar Produced from Beet

Year	Beet purchased by mills (in Tons)	Sugar produced (in Tons)	Recovery
1959	4,570	128	3.03
1960	23,862	2,125	9.02
1961	22,255	1,338	8.28
1962	53,516	4,444	8.30
1963	53,943	3,962	7.34
1964	62,219	6,846	11.00
1965	44,880	4,269	9.51
1966	62,501	6,254	10.01
1967	96,505	8,671	9.99
1968			
1969	1,89,026	18,591	9.84
1970	N. A.	22,549	N. A.
1971	Not	Operated	
1972	1,27,590	14,012	11.01
1973	2,49,226	21,885	8.82
1974	3,24,807	30,622	9.44
1975	2,06,180	22,618	10.97
1976	2,52,130	25,213	10.00

Source: (i) Proceedings of the 11th Convention of Pakistan Society of Sugar Technologists;

(ii) Food Division, Government of Pakistan, letter dated 23.2.1977.

It is gratifying to note that sugar beet is becoming more and more popular in the NWFP where sugar cane is affected almost every year by frost and thus yields lower sugar content. A diffuser of 2500 tons capacity costing

about Rs. 2.5 crores (at current prices) would add 12,5000 tons of sugar to annual production.

In the Province of the Punjab the Agricultural Research Station Faisalabad has undertaken research on growing sugar beet. Some of the sugar mills have also organized experimental cultivation of beet in their zones. Experts think that enough sugar beet can be grown around the mills in the north of the Punjab to feed diffusers of those mills for the month of May. The millowners do not seem to be enthusiastic on investing on a diffuser, which may bring them an additional yield of less than say 6,000 tons sugar per year. They are also apprehensive of getting good crops of sugar beet on a commercial scale for want of manual labour in their zones.

Prices of sugar beet sold to the mills are fixed by the Provincial Government and the system of harvesting and deliveries to the mills operates like sugar cane. In fact, in the case of beet, mechanical harvesting can ensure that there is very little loss of sugar because of the time lag between harvesting and crushing of the crop in the mills.

It will be observed from the preceding paragraphs that sugar beet has a good future in the province of the NWFP and could be counted upon to add to the country's production of sugar by say 50,000 tons per annum at prices which give economic returns both to the growers and the mills.

Experiments are being conducted in the sugar cane section of the Research Institute at Faisalabad on growing such varieties of Sorgum as may start yielding commercial quantities of sugar for a few months of the year when the mills are unable to work on sugar cane. It is hoped that the Institute will be able to make available impressive results to the mills which would stimulate them to invest in encouraging cultivation of that crop in their neighbourhood.

Chapter IV

Consumption and Prices of Sugar

Sugar consumed in Pakistan is of two kinds. The urban areas largely consume white sugar produced by large sized modern mills. The rural areas meet their requirements by the use of 'shakkar', 'gur' and 'khandsari' which are made by the growers generally on their own farms. There is certainly a preference for white sugar even in the rural areas provided it is available at reasonably lower prices compared to the "brown indigenous products". Artificial sweeteners have acquired no place in the sugar market of Pakistan as yet.

Consumption of sugar in Pakistan is very low by international standards. It is much lower than even the quantity recommended by the medical profession for a balanced diet i.e. 29 kilogram per person per annum. The following table gives the standards of consumption reached in some other countries for 1963.

Table IX

Per Capita Consumption of Centrifugal Sugars (raw value 96) In Some Selected Countries (Kilogrammes)

S.No.	Country	Per Capita Consumption				
		1969	1970	1971	1972	1973
1.	India*	5.9	6.9	8.1	7.0	6.7
2.	Brazil	37.5	37.4	39.0	41.7	42.1
3.	Cuba	76.3	72.4	71.2	53.8	52.3
4.	Mexico	39.7	41.2	38.4	40.1	42.3
5.	Phillipines	17.5	16.6	17.5	19.2	19.9
6.	Indonesia	6.8	7.3	7.3	7.8	8.0
7.	Iran	24.4	24.7	27.0	28.5	28.8
8.	South Africa	38.5	39.7	40.3	40.2	42.1
9.	Australia	57.1	56.0	56.4	55.3	58.0
10.	Japan	52.6	29.0	29.4	30.4	30.1
11.	U.S.A.	48.5	51.0	50.3	50.3	49.8
12.	U.S.S.R.	40.1	42.2	42.1	43.4	44.8
13.	Pakistan*	4.7	4.8	4.8	10.4	7.4

Source: Pages 540-41 of U.N. Statistical Year Book 1974.
*These figures cover mill made centrifugal sugar and exclude shakkar etc.

In the case of Pakistan, the total per capita consumption of sugar (including gur, shakkar, etc.) is estimated at about 4 kilogrammes per annum during the Sixties and 7 kilogrammes approximately during the period 1970-74. In 1974-75 the consumption comprised 480,000 tons of white sugar and 1250,000 tons approximately of gur, shakkar & khandsari that is, 19 kilogrammes per capita. During 1975-76, the total availability (all of it is presumed to have been consumed) of white sugar was about 630,000 tons and raw sugar (gur equivalent) was 1323,000 tons. This works out to consumption of 22 kilogrammes per capita of centrifugal sugar of 96 polarization.

Rising incomes, greater urbanization and greater availability of white sugar at reasonable and stable prices is bound to raise the rate of growth of consumption of white sugar and reduce the rate in the case of khandsari, gur and shakkar. Recently an F.A.O Mission (1973-74) on sugar has estimated that the consumption of sugar may rise in Pakistan as shown in the following table:

Table X

Sugar Demand Projections of F.A.O. Mission

Period	Population	White Sugar		Gur/Shakkar/Khandsari (gur eqv.)			
		Growth rate %	Per Capita	Total ann. consumption	Growth rate %	Per Capita	Total Consumption
	(Million)		(Lbs.)	(Long tons)			(Tons)
1961-64		11.9	8.9 (average)	194,000		49	
1970-72	61.5	8.0	17.4 (average)	477,000	1.1	49	1336,000
1980-81	81.2	7.6	28	Over 1,000,000		41	1500,000
1985-86	92.6		36	1,500,000	-	36	1500,000

(Extracted from page 9 of F.A.O. Report No. TA-3257).

The rate of increase in consumption of sugar worked out in Table X seems to be optimistic. The World is increasing its annual demand at the rate

of about 2.35% per annum. This figure also reflects the increase in affluent societies including the oil rich developing states. Table IX shows that the annual rate of increase during 1969-73 in Australia was about 0.4%, in the USA about 0.675%, in Phillipines about 3%, in Japan about 4.4%, in Iran about 4.5% etc. Table X assumes that Pakistan's rate of increase in per capita consumption of centrifugal sugar will be 8% during the Seventies and 7.1% during 1981-85. These figures are far higher than those of our more affluent neighbours including Iran, However, actual consumption is likely to depend considerably upon availability in any particular year. It is shown that it is always possible to squeeze consumption of white sugar in a particular year. In the case of shortage of white sugar or its high price, its total demand shrinks even though demand for sugar in the form of other products e.g. shakkar and artificial sweetners, shows an upward trend. But the Government of Pakistan seems to have accepted the projection made by the F.A.O. Mission. It is recommended that this decision should not be changed inspite of what appears to be an unjustifiable presumption as to the rate of growth of demand. The decision should be actively implemented in view of the country's great need of converting as many of its raw materials into foreign exchange as may be possible.

The availability of white sugar as well as its price have been controlled by the Government almost ever since independence, except for a few years. There was no control or only partial control from October 1966 to October 1968 and October 1970 to 14th October 1972.

The prices of white sugar had been fixed by the Government from time to time. The following table shows the wholesale or retail price of sugar all over Pakistan.

Table XII

Whole Sale and Retail Price (in Rupees) of White Sugar

Period/Year	Whole Sale Issue Price Per Maund Ex-Govt. godown	Retail Issue Price from Govt. Depot Per Maund	Per Seer
Upto 25 May, 1957	44.37	45.00	1.12
26th May, 1957 to May, 1958	49.37	50.00	1.25
4th May, 1958 to February, 1962	54.37	55.00	1.37
Ist March, 1962 to 7th March, 1962	59.37	60.00	1.50
8th March, 1962 to 18th June, 1963	54.37	55.00	1.37
19th June, 1963 to 16th February, 1967	59.37	60.00	1.50
17th February, 1967 to 19th Feb. 1968	54.37	55.00	1.37
20th February, 1968 to 16th Oct. 1968	64.00	65.00	1.62
17th October 1968 onwards			
1969-70	62.50		
1970-71	62.50		
1971-72	58.50		2.00
1972-73	90.00		2.50
1973-74	110.20	117.00	3.00
1974-75	139.00		3.50
1975-76/76-77	160.00		4.00[x]
x since April 1975	since June 1974	since 1.9.76	4.29 per kilo

Source: Production of sugar policies & problems by Abdul Aziz Anwar
Publication No. 148 of Board of Economic Enquiry, Punjab.

Food Deptt., Government of Sind.

The prices at which Pakistani consumers have been able to buy their requirements of sugar have been commented upon elsewhere.

CHAPTER V

SUGAR MILLS

By 1976, Pakistan had 25 sugar mills working on commercial scale. About thirteen of them went into commercial production during the Sixties and eight were commissioned in Seventies. Another by the name of Khazana Sugar Mills went into production of Peshawar in December and the 27th started trial operations at Ranipur (Sind) on 22nd January, 1977. Government sanctions of new sugar mills are issued in terms of cane crushing capacity per day of 24 hours and foreign exchange is released in form of the suppliers of machinery for machinery and equipment of such sizes as would correspond to the crushing capacity mentioned in the official letters of sanction. It has been observed that the millowners were somehow generally able to bargain with the suppliers of machinery to obtain with the foreign exchange officially released by the Government or its financing institutions, mill-houses and power and steam generation facilities which were big enough to handle juice from 500-1000 tons more of sugarcane than the declared capacity of the mills as and when the millowners wished to expand their sugar making capacity by adding locally fabricated equipment for boiling of cane juice, its processing, filteration and crystallization etc. This way, many of the sugar mills set up during the Sixties with a declared capacity of say 1500 tons have already expanded their production capacity to say 2000/2500 tons by using the built-in arrangements even though they may still be paying excise duty on their originally declared production capacity.

There are various processes for producing sugar in the mills. About 80% of the crushing capacity of the mills in Pakistan is today based on what is known as Double Carbonation Double Sulphitation (D.C.D.S.) which is perhaps the oldest known process. It requires use of lime stone, hard coke and sulphur besides some other chemicals. The mills are making plantation

white sugar which is supposed to be 99.70% pure. Most of these mills are faced with a serious problem of disposal of the lime mud which comes out of the filtration stage of this process of sugar making. It has a high percentage of "chalk" and cannot be disposed of easily if the soil of the area surrounding the mills is already alkaline, which is generally the case in Pakistan. Many of these factories have to spend a lot of money on the disposal of such alkaline mud. Besides the Government has to import coke and sulphur for those mills. Mills purchased more recently by Pakistani entrepreneurs are based on different processes, which are considered to be more efficient and economical. Two of the new mills have the Defacation Remelt Boiling Process. One has Single Sulphitation and another one has Double Sulphitation process.

Some of the relevant information about the various mills in production in the country is given in the following table XIII:

TABLE XIII

Production Capacity of Sugar Mills

S.No.	Name of the Mill	Year of installation.	Process Used	Cane Crushing Capacity (Per day) As declared by the Mills	PICIC estimate	Annual sugar production capacity fixed by CBR for excise duty (Tons/Year)
N.W.F.P.						
1.	Frontier Sugar Mills, Takht Bhai	1939	DCDS	1000*	1200	14,000
2.	Premier Sugar Mills, Mardan	1950	"	3750*	3750	45,000
3.	Charsada Sugar Mills, Charsada	1955	"	1800*	2700	26,000
4.	Bannu Sugar Mills, Bannu	1965	"	1500	1500	18,000*
5.	Khazzana Sugar Mills, Peshawar	Started Operation in December 1976.				
			Total	11050	12150	121,000*

S.NO.	Name of the Mill	Year of installation.	Process Used	Cane Crushing Capacity (Per day) As declared by the Mills	PICIC estimate	Annual Sugar production capacity fixed by CBR for Excise Duty (Tons/Year)
PUNJAB						
6.	Cooperative Sugar Mills Rahwali	1932	DS	350	600	6,250
7.	Leiah Sugar Mills, Leiah	1954	DCDS	1200	1500	17,000
8.	Kohinoor " " Juharabad	1954	"	1200	1500	20,000
9.	Cre ent " " Lyallpur	1959	"	1800	2000	30,000
10.	Hyesons " " Khanpur	1963	"	1500	2000	23,000
11.	Fecto " " Daryakhan	1966	"	1500	1800	20,000
12.	Noon Sugar Mills, Bhalwal	1966	"	1500	2000	22,800
13.	Shahtaj Sugar Mills, Mandi Bahauddin	1967	"	1500	2000	22,800
14.	Bahawalnagar Sugar Mills, Chistian	1967	"	1500	2000	22,800
15.	Hussain Sugar Mills, Jaranwala	1967	"	1500	2000	23,000
16.	United Sugar Mills, Sadiqabad	1971	DS & Recry-stalization	1500	2000	30,400
17.	Modern Sugar Mills, Sangla Hill	1972	Defecation & Remelt Phos.	2000	2000	22,800
18.	Shakarganj Sugar Mills, Jhang	1973	Defecation & Remelt.	2000	2000	22,800
			Total:	19050	25400	284,050
SIND						
19.	Fauji Sugar Mills, Tando Mohd Khan	1959	DCDS	1800	2000	31,335
20.	Habib Sugar Mills, Nawabshah	1962	"	1500	2000	23,500
21.	Bawani Sugar Mills, Talhar	1965	"	1500	1500	23,500
22.	Mirpurkhas Sugar Mills, Mirpurkhas	1965	"	1500	1800	23,500
23.	Mehran Sugar Mills, Tando Allahyar	1968	"	1500	1800	22,800

S.No	Name of Mill	Year of installation	Process Used	Cane Crushing Capacity (Per day) As declared	PICIC	Annual Sugar production capacity fixed by CBR for Excise Duty (Tons/Year)
SIND (Contd)						
24.	Al-Noor Sugar Mills, Moro	1970	DS	1500	2000	22,800
25.	Fauji Sugar Mills, Khoski	1971	Defecation, Remelt carbonation.	3000	3000	45,600
26.	W.P.I.D.C. Sugar Mills, Larkana	1975	Defecation Remelt.	1500	1500say	18,000
27.	Consolidated Sugar Mills, Ranipur	1977 (Trial Run)	Defecation Remelt.	1500	1500 say	18,000
				15800	17660	22,800
						233,835
			Grand Total:	44,400	55,150	6,38,835
	Therefore Annual Total/Sugar Production capacity			say 6.0 Lacs** tons	7.5 lacs**	6.4 lac tons

*In addition, these mills have crushing capacity of 1000, 1500/ and 2500 tons per day respectively & Khazana has beethandling equipment for 2150 tons per day.

**Calculated for working season of 160 days and 8.5% mill recovery.

SOURCE: i) Table 4, Proceedings of the 11th convention of Pakistan Society of Sugar Technologists. ii) PICIC, and iii) Sugar Mill Owner's Association Sectt.

The installed capacity of the 25 mills in commercial production by 1975-76, may thus be presumed to be over 6.0 lac tons per year. The figures mentioned in the last column of Table XIII are understood to be based on three years actual production prior to the date of assessment, or on the crushing capacity as may be certified by the supplier of the machine. Their total actual production as well as the production of every mill has been very different and irregular. This has been mainly due to variations in the availability of cane in the areas surrounding the mills. The actual production of sugar at the various mills during the past few years is given in the

following Table XIV:

TABLE XIV

Actual Production of Sugar at Various Mills
(Long tons per crushing season)

S.No.	Name of Mill	1975-76	1974-75	1973-74	1972-73	1971-72
N.W.F.P.						
1.	Frontier	14,399	15,721	9,105	13,398	12,959
2.	Premier	47,834	51,500	29,448	33,973	39,152
3.	Charsada	24,089	28,793	12,571	17,361	16,859
4.	Bannu	14,790	15456	10,640	11,014	12,004
5.	Khazana	Started operation in December 1976				
	Total:	101,112	111,600	61,764	75,726	80,974
PUNJAB						
6.	Kahwali	7,313	6,594	6,108	3,440	2,928
7.	Leiah	21,396	15,422	15,155	15,670	12,370
8.	Kohinoor	22,669	16,697	21,893	16,075	12,860
9.	Crescent	23,339	18,075	26,551	23,865	17,203
10.	Hyesons	34,779	18,551	19,261	18,739	7,579
11.	Fecto (Adamjee)	24,380	20,412	20,462	15,958	12,958
12.	Noon	26,312	25,081	28,483	19,921	15,709
13.	Shahtaj	30,388	30,832	28,454	23,636	16,810
14.	Bahawalnagar	22,693	15,312	19,116	7,478	7,579
15.	Hussain	22,147	18,551	23,757	18,097	19,160
16.	United	34,749	10,203	21,671	11,414	1,042
17.	Modern	25,069	21,422	18,942	2,550	NIL
18.	Shakarganj	18,526	8,542	NIL	NIL	NIL
	Total:	313,760	225,024	250,000	176,751	141,330

S.No.	Name of Mill	1975-76	1974-75	1973-74	1972-73	1971-72
SIND						
19.	Fauji	33,294	33,374	41,062	33,035	21,945
20.	Habib	31,200	20,899	30,833	28,017	9,891
21.	Bawany	23,149	18,611	31,159	20,384	17,918
22.	Mirpurkhas	23,617	13,876	32,022	16,920	10,042
23.	Mehran	20,953	13,840	39,172	17,101	13,370
24.	Al - Noor	30,489	13,764	21,108	19,321	8,456
25.	Fauji Khoski	28,708	27,275	35,307	22,909	19,208
26.	WPIDC Larkana	10,729	Started in 1975.			
27.	Consolidated Ranipur.		Started trials on 22-1-1977.			
	Total:	202,139	143,561	230,664	157,637	100,640
	Grand Total:	616,971	480,185	542,428	410,164	322,944

(SOURCE: Proceedings of the eleventh convention of the Pakistan Society of Sugar Technologists updated).

A fuller picture of the performance of individual mills can be had from Annexure X, which gives figures of cane crushed, sugar produced and average recovery of each mill during the year 1965-66 to 1975-76 separately. Those figures are slightly different from the figures released by the Cane Board or the C.S.O. since they have been taken from the annual reports of the mills received by the Secretariat of the Sugar Mill owners Association.

A large number of new sugar mills have been sanctioned by the Government. Those for which official committments have been made are as under:

	Province/ Division	Location	Capital Cost (Crores of Rs.)	Sanctioned Crushing Capacity (Tons per day of 24 hours)	Process	Likely date of Commissioning
PUNJAB						
1.	Lahore Div.	Pesrur	14.78	1500	D.C.D.S.	1977-78
2.	-do-	Pattoki	14.78	1500	D.C.D.S.	1977-78
3.	-Sargodha Div.	Gojra-Samundri Rd.	26.90	2000	D.R.C.	1978-79
4.	-do-	Kamalia-Toba Tek Singh Rd.	18.80	2000	D.R.C.	1978-79
5.	Multan Div.	Jamalpur (D.G. Khan)	17.00	1500	D.R.C.	1979-80
6.	-do-	Kot Adu Tehsil	Total cost etc. is yet to be determined. Presume capacity will be 1500 and cost will be Rs.26.00 crores.		D.R.C.	1980
7.	Bahawalpur Div.	Ahmedpur East	Total cost etc. is yet to be finalised. Plant of 1500 tons capacity had been quoted at Rs.15.03 crores. Presume total cost will be Rs.26.00 crores.		D.R.C.	1980
SIND						
8.	Khairpur Div.	Dadu	28.00	2000	D.R.C.	1979-80
9.	Hyderabad Div.	Thatta	26.80	2000	D.R.C.	1979-80
10.	Khairpur Div.	Sanghar	26.00	1500	D.R.C.	1979-80
		Total:	225.06	17000		

Besides, it has been decided in principle by the Provincial Governments concerned that sugar mills should be allowed to be set up by private entrepreneurs at the following locations:-

Province/ Division	Location	Proposed Crushing Capacity	Likely date of Commissioning
PUNJAB			
Multan Div.	Okara	Not yet determined since project details have not been finalized.	
Sargodha Div.	Lalian	- do -	
SIND			
Khairpur Div.	Shikarpur	2000	Not yet determined
Hyderabad Div.	Thatta	2000	-do-
Hyderabad Div.	Matli	6000	-do-

The theoretical sugar production capacity, based on their cane crushing capacity per 24 hours of 27 mills installed by January 1977 and the additional ten mills ordered for completion by 1979-80 may be estimated as under:

(A) Production Capacity of Existing 27 mills (as declared):

(i) When recovery is 8.5% and net working days are 160

44,400 x 160 x 8.5 ÷ 100 = 603,840 tons

or say over 6.0 lac tons per year.

(ii) When recovery rises to 9.6% and net working days are 150

44,400 x 150 x 9.6 ÷ 100 = 639,360 tons

or say 6.4 lac tons per year.

B. Production capacity of ten (10) new mills on order:

(i) When recovery is 8.5% and working days are 160 (net)

17,000 x 160 x 8.5 ÷ 100 = 211,200 tons

or say 2.3 lac tons per year.

(ii) When recovery rises to 9.6% working days are 150 (net)

17,000 x 160 x 9.6 ÷ 100 = 244,800 tons

or say 2.45 lac tons per year.

The F...O. Mission of 1973-74 in Appendix II of their report (F...O. No. TA 3257) have suggested the extent of balancing of 24 out of the existing 27 sugar mills at a total cost of Rs. 43.00 crores which should raise in a period of one year or so the crushing capacity of the 24 mills by 20,550 tons per day over and above the existing capacity of 44,400 tons per day of the 27 mills i.e. raise their total crushing capacity to 64,950 tons. It has already been mentioned that private sector mills have been undertaking similar balancing in the past and it should not be difficult for them to do so at the earliest possible date provided they feel interested in the job. Such an increase in production capacity should cost the country only about Rs. 21,000 per ton of additional crushing capacity per day as against Rs. 130,000 approximately per ton of the cost of ten new mills recently ordered from abroad or Taxila. It is, however, suggested that the details of balancing recommended in Appendix II of the F...O. report should be re-checked by a team of experts drawn from amongst the senior members of Pakistan Technologists Association and the financing institutions and their recommendations should be implemented as soon as possible.

Assuming that the balancing of 24 sugar mills would have been achieved by the year 1979-80, the total sugar production capacity available by 1980 should be as under:

(C) Sugar Production capacity of existing 27 mills (when Balanced)

(i) When recovery is 8.5% and working days are 160 (net)

64,950 x 160 x 8.5 ÷ 100 = 883,320 tons
or say 8.8 lac tons per year.

(ii) When recovery rises to 9.6% and working days are 150(net)

64,950 x 150 x 9.6 ÷ 100 = 935,280 tons
or say 9.4 lac tons per year.

(D) Total Sugar Production capacity of 37 mills - (27 existing, as balanced, plus 10 new mills on order)

(i) When recovery is 8.5% and working days are 160 (net)

81,950 x 160 x 8.5 ÷ 100 = 1,114,520 tons
or say 1.12 million tons per year.

(ii) When recovery rises to 9.6% and working days are 150(net)

81,950 x 150x9.6 ÷ 100 = 1,180,000 tons or say 1.2 million tons per year.

IMPROVING EFFICIENCY OF SUGAR MILLS

The sugar production capacity of the mills cannot be used efficiently unless special attention and efforts are devoted to improving the quality and quantity of sugarcane around the sugar mills and the machinery installed is put to optimum use. These matters are discussed in the following paragraphs.

A. DEVELOPMENT OF SUGAR CANE

Despite local and foreign opinion that the standard of Pakistan's sugar mill's operations is quite high and comparable to that of any other cane area in the World, there seems to be plenty of room for efforts and initiative on the part of the mills to put more sugar in the bag per acre of sugar cane. In many countries, high technical and proficiency levels have been obtained on the farms through the assistance of the mills' technologists and managerial officials. Pakistan's mills seem to be doing very little towards discharging this responsibility of theirs and have to do a

great deal in that direction. It is emphasized that it is the responsibility of a sugar mill to ensure, directly or otherwise, that it can obtain the correct qualities of cane in required quantities at the right time, and, a mill which discharges this responsibility efficiently will raise its profit significantly.

The sugar mills in many of the important sugar producing countries of the World are part and parcel of sugar plantations of large sizes. They can therefore obtain fresh cane of high sugar yielding varieties at low costs of production. Since nearly two-third of the cost of production of sugar is the cost of sugar-cane, the sugar mills working within sugar plantations are working at a great advantage as compared to the mills in Pakistan. It is impossible to create sugar plantation in Pakistan because of Land Reforms. However, it should be possible to create conditions around the sugar mills under which the mills can draw not only the required quantities but also the required qualities of cane at the right time. For this purpose the sugar mills must accept the principle that they have to help themselves by helping the growers of sugar cane around their mills in obtaining better yields. They must expand their cane departments and equip them as best as possible to perform, inter alia, the following functions:

(a) Provide specialized Extension Service in the mill ZONES which should be readily available to the growers of cane for rendering advice at various stages of their operations. This service should also organise Seed Multiplication Farms of the mills and Demonstration Plots on the farmer's lands in the mill ZONES.

(b) Set up an organization (by expansion of the Cane Department) to run a Machinery Pool for Ploughing/harvesting the sugar cane acreage of some of the farmers in a scientific manner and cover say ¼ or ⅓ of the Zone Acreage under the crop; provide approved varieties of seeds of early maturing and late maturing in a suitable proportion after necessary chemical treatment and ensure their sowing according to the advice of the cane research stations; provide fertilizers, not only Urea (N) but also K and P. That organization should

supervise that these inputs are used in accordance with the instructions of the research stations and also provide plant protection advice and assistance.

These services should be provided by the mills on payment basis, to the extent feasible, in cash or on credit, as discussed later.

(c) Enter into contracts for supply of cane before the planting season begins, specifying the tonnage to be supplied out of acreage cropped in accordance with the advice of cane departments of the mills and for payment after deducting the cost of in puts provided on credit by the mills. It is important that the contracts should be signed for supply of cane, by weight. Delivery dates should then be so fixed as to ensure supply of fresh and mature cane to the mills. The contracts should also provide for a bonus payment on per maund of cane basis for those growers who strictly follow the advice of the Cane departments of the mills and deliver the contracted quantities of cane according to mills schedule of deliveries.

The function of the Cane Departments mentioned above are discussed further in the paragraphs that follwo and the financial implications are brought out in Annexure IX.

HELP IN LAND PREPARATION

Since the roots of an healthy sugar cane plant go quite deep into the soil, it has been found necessary to plough the land to a depth of at least 12 inches. This is best achieved by disc ploughs operated with the help of tractors. No doubt tractor farming is gaining a foot-hold in Pakistan but the speed is rather slow. It is therefore necessary for the sugar mills to equip their cane departments with tractor farms of suitable sizes. The cane departments should then endeavour to undertake ploughing by tractors on the lands of as large a number of their growers as may be physically possible for them consistent with their resources. In the case of those growers who plough their own fields, the extension services of the mills should try to educate them how deep ploughing is necessary for sugar cane crop. Financial effect of the maintenance of tractor farms by the sugar mills is shown in Annexure IX.

SUPPLY OF SEEDS OF SELECTED VARIETIES OF CANE

The experts at the Punjab Agricultural Research Institute, Lyallpur claim that they have high sucrose content varieties, early as well as late maturing, which should be used for replacement of Col. 54 variety, which is now popularly grown and more or less has outlived its efficient span of life. In a paper on "Some economic aspects of improved cane varieties of the Punjab" read at the eleventh Convention of the Pakistan Society of Sugar Technologists, the results of experiments with three newly evolved varieties are described. The paper concludes that if production per acre of each variety is delivered at the mill, with ½ of it as 4th day stale cane, and the mill works for 160 days crushing 60,000 maunds (2200 tons) per day and the cane is priced on the basis of its sugar content, the economic return as compared to variety Col. 54 would have improved for the grower as well as for the mill, and also enhanced the excise revenue as shown in the following Table XV:-

Table XV

Additional Benefits over Col. 54 due to Improved New Varieties

	Variety		
	B.L. 19	B.L. 4	L. 116
	(in lacs of Rs.)		
Gain to farmer	50.00	90.88	104.64
Gain to miller	3.91	73.50	85.99
Gain to Government when excise duty is assessed on actual sugar production	3.51	64.00	77.24
TOTAL NATIONAL GAIN :	58.30	236.46	267.87

Source: Page 115 of Proceedings of the 11th Convention of the Pakistan Society of Sugar Technologists.

Even assuming that some of the assumptions on which the above results are based may be challengeable, it is obvious that there will be a significant gain to the country's G.N.P. by changing over to B.L. 4 or L. 116. In fact L. 116 is early-maturing variety while B.L. 4 is late maturing. It should be the endeavour of every mill's proposed expanded Cane Department to supply seeds of those varieties in suitable proportion to those who sign contracts for supply of cane to the mill.

The Cane Departments should ensure that the seed is properly treated before it is planted by the grower. It has been recommended that the seed sets should be dipped in chemical solution such as mercurial compound. That should prevent ingress of the fungi and also stimulate germination. The cane department should also endeavour that the growers use only such areas of land for cane cultivation for which they can spare the quantity of irrigation water required to raise healthy crops. In any case the departments should contract only for such quantities of cane as can be expected to grow from the acreage for which the growers have the required quantities of water and supply seed accordingly.

SUPPLY AND APPLICATION OF FERTILIZERS

It is not so difficult for the mills to organize procurement and distribution of fertilizers to their growers. Most of the mills are already doing this, but it is important that the required fertilizers should be used in the right way and at the right time. Overdozes of nitrogen and heavy irrigation can grow large crops but have little sugar in them. Cane departments of the mills must pay special attention to the proper use of fertiliers on demonstration plots and propagate the results. They hould also loan to the growers all the fertilizers in such a ration as is recommended by the research stations and not merely supply Urea (N) to the growers to use as and when they feel like.

It has been established by experiments conducted at research stations that combined use of N.P. & K at proper time and in prescribed proportions can improve sugar recovery in the mills by about 1%. In other words, proper use of fertilizers alone in the fields which have to supply sugar cane to the mills can give additional sugar to the tune of 60,000 tons or add to the G.N.P. about Rs. 16 crores per year, at the current rate of cost of production in the mills and without any change in the present day production capacity.

HELP IN PLANT PROTECTION MEASURES

It will be necessary for the cane departments to maintain close liaison with the Provincial Governments' Plant Protection departments for obtaining necessary assistance for the growers as soon as a disease or pest attack is detected. For this purpose the mills should have an Entomologist on their permanent staff. He may use the field staff proposed to be engaged for seed and fertilizer distribution etc. to keep a watch on the pest activity in the mill zones. But it will also be necessary for Cane Department to keep sufficient stock of chemicals generally required for this purpose and to provide them to the growers when necessary. To encourage anti-pest activity at the level of the growers the mills should consider wholly subsidizing this activity, at least to start with. Effective anti-pest measures are expected to enhance production of sugar cane by at least 10-15%.

PLANNED HARVESTING OF THE CROP

Indents for supply of cane should be carefully made by those members of the staff of the Cane Departments who have been watching the growers' fields. It is of great importance that a sugar mill should receive cane when it is (a) ripe, and (b) fresh. It has been fully established by experiments at the research stations and by the experience of the sugar mills all over the World that the time of harvesting is very important for increased recovery of sugar in the mills. In Pakistan, quality of cane improves greatly upto

January, then the improvement is gradual upto March when the quality reaches its peak. In May, the quality is adversely affected. It is generally not economical to crush the crop in the first two or three weeks of November and after April. It is therefore necessary and in the larger interest of the country that the mills should not be obliged to start crushing the cane from a prescribed date of the year e.g. 1st. of November. This should be left to be decided by the experts of the Cane Departments of the mills.

The extent of sugar lost by harvesting the cane too early or in May can be better appreciated from the following Table XVI:

Table XVI

Raw Sugar Recovery % (Average of 3 Years - 1971-72 to 73-74)

Month	Varieties			
	Co. L. 54	B.L. 19	B.L. 4	L. 116
November	8.97	9.45	11.42	12.04
January	11.82	10.95	12.93	14.02
March	12.52	10.32	13.33	14.14
May	6.64	7.40	9.61	8.74

Source: Page 119 of Proceedings of the 11th Convention of the Pakistan Society of Sugar Technologists.

Thus it can be seen that all the varieties of cane give lowest recoveries during the month of May, but Co. L. 54, which is overripe these days gives least recovery in the month of May rendering the extraction of sugar uneconomic for the mills. Thus if a factory starts crushing on 1st of November and continues crushing upto May it runs the risk of wasting a lot of sugar. Secondly it has been observed that the crop which is cut after April gives a very bad ratoon and thereby adversely affects the production in the following year.

The most important duty of the Cane Departments is to issue indents for delivery of cane. It is important to ensure that only fresh cane is received in the mills. It has been observed in experiments at the Research Institute, Faisalabad that when cane is harvested it looses about 1% of its weight per day for the first week. The loss of sugar in the cut cane is much quicker in hot dry weather. The extent of loss of sugar in different varieties when half of the cane delivered to the mills had been harvested four days before the delivery is shown in the following Table XVII:-

Table XVII

Estimated Loss of Sugar from 50% Stale Cane

Variety	Recoverable white sugar %		
	Fresh Cane	At Mill	% Loss of Sugar
Co. L. 54	10.24	8.90	1.30
B. L. 19	9.83	9.02	0.81
B. L. 4	11.36	11.09	0.27
L. 116	12.06	11.54	0.52

Source: Page 108 of Proceedings of the 11th Convention of the Pakistan Society of Sugar Technologists.

Thus, if half of the cane crushed by a factory of 2,000 tons crushing capacity per day, working 150 days, is delivered four days after harvesting, the total loss of sugar in case of Co. L. 54 variety works out to 390 tons or so, which is equivalent to over Rs. 10.00 lacs at current cost.

The above table also shows the need of sowing the right variety and linking the price of cane with its sugar content recovered at the mill. It is hoped that a mechanism about how to link the price of cane to its sugar recovery at the mill will be evolved before long.

OTHER ASPECTS OF CANE DEVELOPMENT DEPARTMENTS EXPANSION PROGRAMME

The expanded Cane Departments of the sugar mills will need additional trained staff as well as credit facilities if they are to perform the important role of developing and developing readily the cane crops of their zones. It will be necessary to place development activities of the Cane Departments under the charge of senior officers, say, Additional or Deputy Cane Managers. They should be supported by adequate strength of trained technical staff, say on the lines indicated in Annexure IX. In so far as credit facilities are concerned, it should be possible to arrange for the same in a number of ways. Perhaps, the required credit should be extended to the mills for this purpose by the Agricultural Development Bank on the same lines as the House Building Finance Corporation is providing credit to companies for building multistoried flats in the urban areas. It may be possible, when the scheme for Cooperative farming has gained some experience to pool the sugar cane growers of a mill zone into one Cooperative Society, which can establish long term relationship with the mills' Cane Department. In the meantime the commercial banks should be happy to finance such an activity out of their credit allocations for the Agriculture sector.

The total credit requirements of an expanded cane department will vary from mill to mill. A rough estimate of requirements has been worked out in Annexure IX. It should be seen that 27 mills now operating will need credit of about Rs. 16 crores per year for development of cane crop. The cost of additional staff to be employed on a permanent basis is proposed to be met from the mills' own resources and added to the cost of production accounts.

It is estimated that from the year 1980-81, after Cane Department of the mills have had experience of two or three years in performing their expanded functions, the mill zones' production of cane should have improved to about 9.6% sugar recovery in the mills and 25 tons (680 maunds) of cane yield per acre.

This should improve the income of the grower by over 300% when compared to Annexure I, of the 27 sugar mills by about Rs. 7.5 crores per year as well as of the Government if excise duty is levied on a revised and more rational basis.

It has been mentioned earlier that by 1980-81, Pakistan should have 37 sugar mills operating to produce about 1.2 million tons of sugar if recovery is 9.6% and working season is of 150 days, on the average. This will require cane from about 588,235 acres, inclusive of 15% of production required production of sugar/for seed, chewing and wastage provided the yield per acre is about 25 tons in the mill zones. This area is about 37% of the total acreage under sugar cane today i.e. almost equal to the present day ratio of consumption of cane by the modern large milling sector. Thus it should not be necessary that any additional acreage be diverted to sugar cane crop to meet the increased requirements of the 37 mills.

It is emphasised for the benefit of the possimists that the proposed increase in cane production per acre and sugar recovery in the mills is expected to be achieved only in the MILL ZONES through the efforts of the MILLS themselves, helped, wherever necessary, by the Government. In other words, intensive efforts to improve sugar production in the field would be concentrated only in about ONE-THIRD of the total acreage under sugar cane. Even this is a difficult task but certainly not Herculean. Recently some of the mills have started taking a much more active interest in developing sugar cane in their zones. Cane Board also seems to have started taking much more active interest in pursuing the mills to pay much greater attention to this work. Perhaps the Cane Board may like to lay down in consultation with each mill its annual targets for (i) inputs to be provided per acre, (ii) acreage to be covered in the Zone, (iii) staff to be employed for the purpose, (iv) average yield per acre to be achieved in that particular year, etc.

B. DEVELOPMENT OF SUGAR EXTRACTION IN THE MILLS

The sugar factories will have to undertake development work within the mills as well to get the maximum sugar out of the improved cane supplies developed and procured by their Cane Departments. The mills will have to be not only balanced to make full use of the crushing capacities of their mill-rollers already installed but, in most cases they may also have to improve their total production and profitability by using more efficient processes and techniques as mentioned below.

BALANCING AND MODERNIZATION OF EXISTING MILLING CAPACITY

Since the establishment of most of Pakistans' sugar mills in the Sixties, the techniques of recovering maximum possible sugar from the cane have developed further. These developments are known to our mills. For example, it has been established that the addition of a shredder to the milling system of Hyeson Sugar Mills has increased their extraction of juice to such an extent that the investment made on it had been more than justified within a year or so. New processes of recovering sugar from the cane juice are being used and even Pakistan has been able to see the working of a couple of new mills based on Defaction Remelt Process. It has been established by the General Manager, Noon Sugar Mills, Mr. A.H. Ansari, in his paper on "Defaction Remelt Process in Pakistan" read at the 11th Convention of Sugar Technologists of Pakistan that "white sugar produced by this process is cheaper than carbonation sugar because of low operating cost and small manpower requirements. The most remarkable point of the process is that no imported raw material is used. A total saving of Rs. 32,84,000.00 is possible per year per mill on consumbale stores (including coke and sulphur)". Mr. Ansari has advocated that the old existing sugar mills should be modified to use that process instead of the D.C.D.S. According to his calculations this can be done with an additional investment of a few lacs of rupees worth of equipment. The process has various

other advantages e.g. filter mud is only 3% of the cane crushed and not 8% as in D.C.D.S. process and is also acidic in action and as such very suitable for manuring Pakistani soils affected by salinity.

Excise Duty: It will greatly help in raising yields of sugar per acre of the excise duty is levied on actual production of the sugar mills. At present, the mills go on crushing cane as long as possible so that they can produce more sugar than their assessed production capacity and save Rs. 50.00 or so per maund of sugar made in excess of their capacity fixed by the C.B.R. It is a well established fact that the sugar cane looses its sugar content rapidly in the hotter months i.e. after April. Thus crushing of cane is not only a net loss to the mill, unless it is subsidized by non-levy of excise duty, it also hampers the working of the mill in the following year since the Ratoon Crop is bound to be adversely affected in many ways. Above all, the present system acts as an impediment to growth of production capacity in the existing mills. In order to avoid upward revision of their excise duty, the mills are not taking any interest in expanding their production facilities which may be possible by the addition of equipment here and there in the various departments of the mills.

SUGAR CANE REQUIREMENTS OF THE LARGE SIZED MILLING SECTOR

Pakistan's total consumption of white sugar, as will be observed from Chapter IV, will go on increasing and may be assumed to be about one million tons per year by 1980-81. It has previously been observed that this demand can be met by increasing production from the existing resources of land and water being used for the production of cane, and already installed 27 sugar mills.

The present acreage under cane is roughly speaking 1,600,000 yielding an average of 15 tons per acre and 8.5% mill recovery. At present, the combined sugar production capacity of all the mills (27) installed to date may be

assumed to be about 600,000 tons per year. For this, the mills consume cane produced from about 1/3 of the total acreage under cane. It is hoped that the yield of cane per acre will go up to about 25 tons by 1980-81 in the mill zones and recovery in the mills will rise to about 9.6% working 150 days in a year. It should not be difficult to achieve these targets if the suggestions made earlier are effectively carried out by the mills and the growers. Based on these figures, it appears that the present milling capacity, after the necessary B.M. & R. and after supplying the required in-puts to the cane crop and carefully organising harvesting of the cane in the zones, should be able to get an assured supply of about 11,467,000 tons of cane (after providing 15% for seed, wastage etc.) from 458,680 acres only i.e. from about 30% of the total cane acreage of these days, which, when processed should yield about 935,280 tons of white sugar. This figure is quite close to Pakistan's consumption estimate of 1980-81.

When all the 37 mills are operating, they are expected to produce 1.2 million tons of white sugar if rate of recovery is 9.6% and working season is of 150 days. This will require sugar-cane production from about 588,235 acres, after providing 15% for seed, wastage etc., provided the yield per acre has risen in the mill zones to 25 tons per acre. That area is about 37% of the total acreage under sugar cane to day i.e. almost equal to the present day ratio of consumption of cane by the modern large milling sector. Thus it should not be necessary to divert any additional acreage to sugar cane crop to feed the 37 mills.

FUTURE MILLS: The government is announcing decisions to let private entrepreneurs set up five (5) new large sized sugar mills with a total crushing capacity of about 14,000 tons per day. It is strongly advocated that when final decisions are taken, expert opinion should be followed in respect of:

(a) Economy of scale of production: There is a growing tendency in the World to instal sugar mills of largest possible size consistent with prospects of arranging mills requirements of cane. For example, Egypt's latest sugar mill will have 8,000 tons of daily crushing capacity which will work largely on cane to be grown by a large number of farmers in the neighbourhood of the mill. Pakistan already has experience of running two mills of more than 3,000 tons crushing capacity.

(b) Use of most economical process and latest techniques: Double CARBONATION Double SULPHITATION process should be discarded, and the inclusion of shredders in the milling plant of the new mills should be seriously considered.

(c) Location of the Mills: In view of the scarcity of irrigation water, the new mills should be installed in the areas in which cane is already being grown or where water in sufficient quantities can be supplied to raise sugar cane on about 15-20,000 acres per mill of 2,000 to 3,000 tons crushing capacity.

COST OF PRODUCTION

On the basis of cost of production worked out by the Government, the ex-mill price of white refined sugar was fixed for the year 1975-76, and the same continues for 1976-77, at Rs. 160 per maund in respect of old mills. For new mills, a premium of Rs. 10.00 per maund over the above price has been allowed. It is understood that the cost per maund was assessed as under:-

Table XVIII

Cost of Production of White Sugar

ITEM	NWFP	PUNJAB	SIND	BALUCHISTAN
Price of Sugar cane (per maund)	5.50	5.70	5.90	
Sugar Recovery	8%	8.6%	9%	
(a) Cost of Sugar cane required to produce one maund of sugar	68.75	66.86	65.86	67.05
(b) Cost of Conversion:				
(i) Salary, wages, bonus				9.31
(ii) Process, stores & maintenance spares				8.87
(iii) Packing material				2.75
(iv) Depreciation				6.00
(v) Interest				4.65
(vi) Insurance				0.45
(vii) Admn. expenses & overheads				3.25
(viii) Credit for molasses			(-)	3.50
		Net Conversion Cost		31.78

(Contd....Table XVIII)

ITEM	NWFP	PUNJAB	SIND	BALUCHISTAN
(c) Excise Duty				50.48
(d) Market Fee				0.75
(e) Development Cess on cane				1.12
(f) Profit for the mill				8.82
	TOTAL			160.00

Source: Food Department, Government of Pakistan.

Based on the above figures, the average cost of production of one maund of sugar, excluding excise duty and profit margin of the mill, works out to say Rs. 105.70. It appears from Annedure VIII that after a couple of years or so when cane cultivation would have improved by the measures proposed earlier, the cost of cane required by the mill to produce one maund of sugar will be reduced to an average of Rs. 61.20 (after payment of Rs. 0.25 per maund as quality premium) and thus the average cost of one maund of sugar should come down to Rs. 99.85. As against this price (Rs. 99.85) the National cost of sugar cane (Rs. 4.25) required for producing one maund of sugar will be Rs. 44.285 and the National cost price of sugar should be Rs. 82.94 only.

The picture will probably change when the ten new sugar mills sanctioned at an investment of Rs. 225.00 crores also come into production, and the existing 27 mills have expanded to an average crushing capacity of 2,750 tons per day. Then:-

A. Total annual sugar production of 27 mills (after B.M. & R as recommended). = 9.35 lac tons

B. Total annual sugar production of new mills = 2.45 lac tons

C. Total annual sugar production of 37 mills. = 11.80 lac tons

COST OF PRODUCTION OF ONE MAUND OF SUGAR

Assumptions: (a) Recovery in the mill is 9.6%

(b) Yield of cane per acre is 25 tons (680 maunds)

(c) Cost of cane to the mill includes premium of Rs. 0.25/maund

(d) Figures used below are as per Table XVIII except where indicated otherwise.

Table XIX

Item of Expenditure	Mills Cost for	A	B	C	National Cost (C)
I. Cost of cane *(delivered at mill)	Quantity:	10.42	10.42	10.42	10.42
	*Rate	5.875	5.875	5.875	* 4.25
	Total:	61.218	61.218	61.218	44.285
II. Conversion Cost (excluding Dep. & Interest		24.63	24.63	24.63	24.63
III. Depreciation[2]	(on present investment)	6.65	16.88		
	(on new investment)	26.74	16.88	/3	/3
		33.39	33.76	33.47	33.47
IV. Market Fee + Development Cess /4		1.66	1.66	1.66	1.66
V. Credit for molasses	(-)	3.11	3.11	3.11	3.11
	TOTAL:	117.79	118.16	117.87	100.93

NOTES: *See para 48 (c). For National cost of cane, see Annexure VIII.

/2 See Annexure IX. Depreciation on present investment has been reduced from Rs. 6.0 to Rs. 2.0 in 1980-81.

/3 This is weighted average of A. & B.

/4 Calculated for reduced maund-age of cane required for one maund of sugar.

The price at which sugar is sold ex-mill, for public consumption in Pakistan is, on average, say Rs. 165.00 per maund. Adding transport etc.

It is sold in the retail market at about Rs. 4.00 per seer. This works out to Rs. 4850.00 per ton or U.S. $ 485 per ton at Karachi. It would have been extremely useful to compare these figures with the corresponding figures of other sugar producing countries. Unfortunately, comparable data of recent past of other countries is not readily available. The prices at which trading takes place in the international markets are also not a dependable index of the cost of production of the countries selling their sugar. During the Sixties, most of the countries were known to be selling below their cost. Since 1973, the prices have become extremely unstable and touched as high a figure as U.S. $ 1100 per ton in December 1974, which obviously provided an abnormally high margin of profit. The present prices in the international market are quite low as compared to 1974-75-76, but they may move up significantly in the not too distant future. But the prices abroad are not expected to touch the peak of 1974. However, it is quite possible that the international price may again rule around U.S. $ 400.00 per ton. Thus, on the whole, the consumer of white sugar in Pakistan may have been at times, paying higher prices than the international market, but they had the advantage of stable and reasonable prices, though through the mechanism of rationing.

CHAPTER VI

GUR, SHAKKAR, DESI-SUGAR

Until the year 1949, barring 20,000 tons of white sugar produced by two small mills capable of crushing only 1350 tons of sugar-cane per day, Pakistan met its requirements of sugar either by imports of white sugar or by locally made brown sugar manufactured on a cottage scale basis in the rural areas out of their own huge production of 65,26,310 tons of sugar-cane per year from approximately 5,00,000 acres. Even at that time sugar-cane was perhaps the fourth or fifth largest crop of the country and Pakistan was perhaps the fourth largest producer of sugar-cane in the World. After about ten years of independence Pakistan still depended upon village level cottage scale fabrication of sugars to the extent of about 86% of its requirements. And today when mill made white sugar can be produced to the extent of over 6,00,000 tons per year by the 27 sugar mills of Pakistan, the cottage industry still consumes about 50% of the total crop and produces approximately 13.5 lac tons of brown sugar in the form of gur, shakkar and desi-sugar. In some years, a small part of the cane supply has also been consumed by small sized khandsari units which were installed around 1965. It will thus be seen that cottage industry has played a dominant role in the supply of sugar in Pakistan.

If the entire production of sugar cane is to be converted into white sugar, it will be necessary to have at least 75 mills of 2000 tons crushing capacity per day or an additional 40 mills at a cost of Rs. 1000 crores approximately (the latest estimate of cost of a new sugar mill by the Industrial Management Board is more than Rs. 25 crores or so). It is obvious that such a huge investment, i.e. about 10% of the total five year plan (1976-80) investment is not possible in the foreseeable future. The country will, therefore, have to continue to depend on cottage industry for a large part of its requirements of sugar for a long time to come.

It is well known that sugar making cottage industry suffers from inefficiency at every stage. It recovers only 5% to 5.5% of sugar from the cane as against the present day national average recovery of 8.5% by the sugar mills, which is expected to rise to 9.6% in the mill zones in the near future because of concerted efforts on the part of the mills. Thus if the villages are making sugar out of 50% of the present day crop and loosing 3.5% of the sugar content of the cane production the total loss of the country works out to roughly speaking Rs. 100 crores worth of sugar per annum, calculated at the current rate of cost of production of an average sized sugar mill in Pakistan.

While the cottage scale manufacture of sugar is inefficient and wasteful, their product is considered to be very nourishing and a healthy food, more so than white sugar from which everything but pure crystal sugar has been removed. But there is a school of thought which asserts that it is a source of hazards to the health of consumers. However, it cannot be denied that this industry has its own beneficial characteristics. Among others, it provides a means of converting a perishable crop into preservable form of an essential item of human diet. During the three months of mid December to mid-March, the farmers have little to do on the farms and they usefully utilize that period in making gur/shakkar and provide employment to a fairly large number of rural labour force. The equipment used by this industry is made entirely within the country and its cost is very little. The equipment can also be borrowed or hired from the neighbours. Even in the cane zones of large modern sugar mills, the cane which is not purchased by the mills is converted into gur etc. and thus saved from complete wastage. Sugar cane is grown over a very large part of the country and as such this cottage industry spreads its benefits over vast areas of Pakistan.

It will be interesting to examine the cost of production of gur. Table XIX below gives the cost of the years, 1957-58, 1968-69 and 1974-75:-

Table XIX

Average Cost of Making One Maund of Gur

Item of Expenditure	COST PER MAUND 1957-58 x	1968-69 xx	1974-75*
1) Rent for hire of mill	0.50	1.64	3.50
2) Pair of bullocks to operate the mill	1.12	4.00	10.00
3) Wages of man to drive the bullocks	0.37)	3.85	
4) Labour	1.13)		15.00
5) Chemicals	0.25	0.93	
TOTAL:	3.37	10.42	28.50
Price of Cane used (10 maunds.)	15.0	25.0	57.50
Total cost of 1 maund of gur	18.37	35.42	86.00

Source: x Pakistan Sugar Commission (1957-59)

xx Board of Economic Enquiry Punjab (1971) Page 97, Publication No. 148.

* Cane Botanist, Research Institute, Faisalabad.

Thus the cost of making gur seems to have gone up 3 times during the 10/11 years (1958-69) and further increased by 240% during 1969-75.

The prices of gur in the wholesale markets have been widely fluctuating from year to year and market to market. The following Table XX gives some idea of the wide fluctuations:-

Table XX

Average Wholesale Price of Gur in Selected Markets
(Rs. Per Maund)

YEAR		Faisalabad	LAHORE	MARDAN	R E M A R K S
1964-65	x	31.34	37.00	39.49	
1965-66	x	17.55	22.48	37.65	
1966-67	x	14.44	19.77	32.90	
1967-68	x	30.81	34.37	37.17	This was a year of great scarcity of sugar in Pakistan.
1969-70	x	21.38	23.20	48.10	
1970-71		N. A.	N. A.	N. A.	
1971-72		N. A.	N. A.	N. A.	
1972-73	*	75.00	83.25	76.19	
1973-74		80.00	72.20	105.00	
1973-74	*	75.00	75.20	70.00	
		76.00	75.25	105.00	
1974-75	*	70.00	75.25	70.00	
		76.00	80.66	95.00	
1975-76	*	67.75	69.31	95.00	
		70.00	80.66		

Source: x Board of Ec. Enquiry Publication No. 148 - Page 99
* Food Department, Government of Pakistan letter dated 23.2.1977.

The above table XX will also show that when the prices of gur are compared with those of white sugar there seems to be an established rule that gur prices are always lower than those of white sugar irrespective of the total production. It is also clear that the cost of production of gur is not the

only factor regulating the wholesale prices of gur in the mandis. In certain years the cost of gur works out higher than the wholesale prices in the nearest "mandi" and vice versa, and yet the production of gur continues to the extent of availability of cane. The farmer has no option but to convert his cane into gur if he cannot sell his crop to sugar mills otherwise his crop will go dry and thus be completely wasted. The farmers will have to make gur out of his surplus cane, no matter what the net return obtained by him by this operation.

As stated above, gur and shakkar are still by far the main source of sugar in the rural areas. It is used to some extent even in the urban areas. There is, however, a very distinct trend towards ever increasing consumption of white sugar. This is directly linked with increase in per capita incomes, urbanization and manufacturing industries. It is, therefore, estimated that the per capita consumption of gur and shakkar will not rise in the future. The F.A.O. Mission of 1973 have estimated that this demand (per capita consumption of gur equivalent) will drop from about 49 lb. in 1970-71 to 41 lb. in 1980-81 and to 36 lb. in 1985-86. The total production of gur equivalent may rise from the 1.35 million tons level of 1970-71 to 1.5 million tons by 1980-81 and remain practically unchanged throughout the eighties.

The Government of Pakistan seems to have accepted these projections and there seems to be no reason to disagree with the basic concept underlying these assumptions. But even if the quantum of production of gur equivalent remains almost stationery from 1985 onwards, it will be a consumer of about 50% of the sugar cane crop. It should therefore be an important part of the plan for the development of sugar industry of Pakistan that concrete steps are taken to reduce wastage of sugar in gur making process. The Sugar Commission had drawn attention of the Government to this important cause as early as the year 1958, yet nothing significant seems to have been done so

far. However, the Appropriate Technology Development Cell of the Planning and Development Division has prepared a project to organise experiments for evolving an improved device for cane juice extraction at village level and the Sugar Board has given its support to that scheme. It is hoped that efforts in this direction will be pursued more seriously and speedily so as to save the country from at least a part of the annual loss of about Rs. 120 crores worth of sugar. No doubt the best solution lies in processing the entire sugar-cane production in modern sugar mills. But till the resources for manufacture of 'White sugar' in such units can be available for handling the entire crop, the next best alternative should be given fullest possible support. The Second best solution should be adopted as quickly as possible as discussed in chapter VII.

CHAPTER VII

KHANDSARI INDUSTRY

A very significant step was taken for the development of sugar industry around the year 1960-61, but, unfortunately, this does not seem to have received that continued attention and support of the Government of Pakistan which is so essential for the successful establishment of any industry. The Second Five Year Plan (1960-65) provided Rs. 1.6 crores for investment in the private sector on the establishment of 30 units of Khandsari (sugar) industry. Eight of these units were to be imported from India with the help of foreign exchange loans granted by PICIC. The cost of a plant of this kind was then estimated at Rs. 6 lacs, including Rs. 2.5 lacs in foreign exchange if the machinery was imported from India. Local engineering firms of repute, e.g. Peco of Lahore, Crescent and Star Engineering Works of Gujranwala and a few others were prepared to fabricate that kind of plant wholly within Pakistan. However, only 12 such units were actually installed in different parts of Pakistan with a total capital investment of Rs. 1 crore each having a crushing capacity of 1500/1600 maunds (about 60 tons) of cane per day of 16 hours. Eight of these units were imported from India and the remaining four were made wholly in Lahore and Gujranwala. Most of these Khandsari units were established in such areas where cane was grown extensively but had no sugar mill in the neighbourhood. The locations of the Khandsari units established during the second Five Year Plan period were as under:-

LOCATIONS OF KHANDSARI UNITS

Province	District		Location
N.W.F.P.	Mardan	1)	Shahbaz Garhi
PUNJAB	Lahore	2)	Manga Mandi
		3)	Pattoki
		4)	Wan Radha Ram
		5)	Luliani
	Faisalabad	6)	Chiniot
		7)	Gojra
	Mianwali	8)	Pipian
	Sahiwal	9)	Okara
		10)	Kamand
	Multan	11)	Tatepur
SIND	Nawabshah	12)	Moro

It may be mentioned here that "Khandsari" is manufactured by boiling the cane juice in open pans, as used for gur making, but the clarification of the juice is done by the single sulphitation process, employed by some of the modern sugar mills. The crushing of cane is carried out with hydraulically operated crushers which give 65 to 70 per cent of juice extraction as compared to about 40%* extraction obtained by the bullock driven crushers used by the villagers for making gur and over 90% obtained by the modern sugar mills. As a result, the sugar produced is fairly white and crystalline and the sugar recovery is about 6.5% as against 5% of gur and 8.5% of modern mills. It is, however, not very clean since it is dried in sunshine on open cement platforms. But some of the above mentioned units, e.g. Manga Mandi,

* See page 12-Agenda of 21st meeting of Sugar Board held in June, 1976.

have installed locally fabricated dryers, which do not need any steam for operations, and are thus capable of producing much better quality of Khandsari, though still inferior in quality to the product of a modern sugar mill.

The cost of production of sugar by Khandsari units is always less than that of a modern sugar mill, inspite of those mills having the advantage of economy of scale of operations. The Committee on Khandsari Sugar Industry had estimated in 1968 the conversion cost of a Khandsari unit as Rs. 0.82 per maund of cane crushed. Assuming an average recovery of 6% and price of cane at Rs. 1.75 per maund, the Board of Economic Enquiry, Punjab estimated in 1970, that the cost of production worked out to Rs. 42.84 per maund of Khandsari as against over Rs. 60.00 per maund (in 1970) from a well organised mill of 1500 tons crushing capacity.

It should be noted here that Khandsari units did not have of pay the minimum prices of sugar cane fixed by the Government for sugar mills. It is a fact that the Khandsari units could buy the sugar cane required by them at prices considerably lower than the fixed prices i.e. Rs. 1.75 against 2.50 fixed for the sugar mills in 1970.

Roughly speaking, all the Khandsari units listed above can give a combined production of over 5,600 tons per year, assuming rate or recovery to be 6.5% and working season to be 120 days but all of them had to close down in 1965/1966, due to certain developments beyond their control. The performance of Khandsari units could have been considerably improved if the recommendations made by the Committee on Khandsari Industry (1969) had been followed. The cost of the additional machinery recommended for installation in those units was estimated to be around Rs. 1.00 lac in local currency only. That could have enabled those units to achieve 7% sugar recovery, work on three shift basis and for about 130 days a year and raise

the total output of the installed units to more than 6,800 tons per year of improved quality sugar. This would have been quite a satisfactory performance as compared to that of a large sized modern mill requiring capital investment (in 1962) of Rs. 2.50 crores and producing about 20,000 tons of refined sugar. It should also be kept in view that those twelve units of Khandsari could have recovered 1800 tons more of sugar from the cane crushed as compared to the recovery by gur makers. This would have added about rupees forty seven (47) lacs more to the G.N.P. if today's price of Khandsari is assumed to be about Rs. 2,500 per ton. But the Government considered it desirable not to withdraw the excise duty levied on Khandsari units. The investment made in those units is now lying idle.

It should obviously be the deliberate policy of Pakistan to establish every year as many units of mechanized sugar extraction as may be possible to replace gur making and thereby save as much of sugar loss of Rs. 120 crores equivalent by the crushing of sugar cane in bullock driven crushers as may be humanly possible. Luckily, large sized modern mills imported from abroad or made at Taxila (which can perhaps make only two units of 1500 ton capacity in 18/24 months with 33% of the total machinery being imported), at abnormally high prices is not the only answer to the problem. Pakistan has local manufacturers around Gujranwala who have been making components of various departments of existing modern sugar mills. These manufacturers can be organized to produce complete MINI SUGAR MILLS at extremely competitive prices but (i) the crushing capacity of these units cannot be more than 150 to 500 tons per day (24 hours), (ii) the units will not include power generation facilities as is the case with the large mills, and (iii) the units will produce what is traded internationally as "RAW SUGAR". One of those manufacturers of Gujranwala is understood to have been approached

by a World famous supplier of complete sugar mills to take up manufacture of the proposed small units for supply to foreign countries under their marketing arrangements. The author of this study had the pleasure of obtaining a tentative quotation from the same source. They would be able to supply two complete raw sugar making plants of 500 ton capacity each in a year at a cost of Rs. 2.50 crores per plant, including Rs. 25.00 lacs in foreign exchange required for the import of stainless steel tubes etc. The plant will include 4 sets of mill rollers of 42" x 22" each, a shredder, motors of variable speed, pans to be heated by steam for which locally fabricated boilers will be included, sulphitation of raw juice, six centrifugals and other requirements to fully match the crushing capacity right upto the bagging house. Such a mill should be able to produce annually 6,000 tons of raw sugar, which is about 92% pure, working 150 days in a year and giving about 8% average recovery. It will save 2250 tons of sugar per mill from going waste or add every year about Rs. 65 lacs to the G.N.P. (or Rs.2850/- per ton of raw sugar) if the cane used by it had been crushed for making gur. The capital cost per ton of crushing capacity installed (assuming Rs. 2.75 crores to be the total cost after adding the cost of civil works and getting power connection from WAPDA) will work out to Rs. 55,000.00 only as against over Rs. 130,000.00 for a new large size modern mill for refined sugar.

It may be pointed out here that the proposed small units for manufacture of raw sugar, though fully mechanised, will have many advantages over the large sized sugar mills. Firstly, the machinery required will be wholly fabricated within Pakistan. It should not be difficult to organise production capacity of such units so as to produce FOUR complete Mini Mills per year. The manufacturer mentioned above may need to install additional machinery

(imported) worth Rs. 1.00 crore or so plus some cooperation from Taxile Complex to reach this target single handedly. A Unit of 500 ton crushing capacity will need only 5,000 acres of sugar cane to keep it busy for the full season of 150 days even if the yeild per acre around such mills does not exceed the present day national average of 15 tons. Thus such units need not have any complicated procedures for obtaining their requirements of sugar cane especially when the Mini Mills are owned by the agricultural cooperative societies. The elements of depreciation, administrative overheads, chemicals and a number of other items to be included in the cost of production accounts will be much lower than those of large units. The quality of the output of such units should be that of internationally traded RAW SUGAR.

But it has to be emphasised that such units cannot grow at a fast pace unless Government patronage and protection is available for a number of years to follow their coming into production. Definite preferential treatment will have to be meted out to those units in respect of excise duty, if it has at all to be levied at some stage of their coming into production. WAPDA will have to provide steady current of electricity to such units in preference to many other categories of consumers, since it is not proposed to provide electric generation facilities within the units. In fact it will be necessary for the Government of Pakistan to publicly announce a policy of preferential treatment and active assistance to such units. The sooner it is done, the better for the sugar industry of Pakistan will it be.

CHAPTER VIII

BY PRODUCTS

There are a number of well known by-products of the sugar industry. Modern technology calls for fullest possible utilization of the raw materials of sugar to make its manufacture more economical and efficient. It is necessary that the by-product of sugar industry of Pakistan should also be properly and fully utilized to make the best use of the country's large production of sugar-cane.

In Pakistan, the two main by-products of sugar industry are Molasses, and Bagasse from sugar cane and molasses and beet pulp from the processing of beet. Of the sugar cane crushed in a sugar mill in Pakistan, about 4% production by weight is molasses and 14% is bagasse (bone dry fibre). These by-products can be had in quantities only from the sugar mills. All the bagasse produced by the makers of gur, shakkar etc. is burnt as fuel. Except a few sugar mills which have been provided with gas, all others burn their bagasse wet, as it comes out of the mills. The quantity of molasses produced by the gur makers is difficult to estimate since it is almost wholly consumed in the rural area for making "hooka" tobacco. Some of their production is also sold to foundaries and even some distilleries. In many sugar producing countries molasses have also been used as an organic manure on the soil, but in Pakistan this is a rare phenomenon. By and large, the entire production of molasses of the sugar mills of Pakistan is being exported to foreign countries, and only partly utilized for making industrial and rectified alcohol. A small portion of the molasses is also used for making poultry and cattle feeds.

The following Table XXI will give an idea of the production of baggasse and molasses in Pakistan:-

Table XXI

Bagasse and Molasses Production in Pakistan's Sugar Mills
(Estimates)

(Long Tons)

YEAR	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Projections 1980-81
1) Molasses	283,191	140,202	166,750	234,071	250,000	310,000	440,000
2) Bagasse (Bone dry fibre)	898,226	516,894	643,328	949,696	816,000	1020,000	1540,000

Source: Page 242, Proceedings of the 14th Convention of Pakistan Society of Sugar Technologists.

It is well-known that molasses are being used in the world for the manufacture of animal and poultry feeds, yeast, citric acid, mono-sodium glutemate, and alcohol, apart from being used as an organic fertilizer. Pakistan has five distilleries of which four have production capacity of 5000 gallons per day of good quality industrial alcohol and one has 10,000 gallons capacity. These can consume 500 tons of molasses per day and by working 120 days in a year, they can consume 60,000 tons Therefore, most of the production of molasses is surplus and is exported. Roughly speaking, about 200,000 tons of molasses are exported these days every year to earn about Rs. 7 crores in foreign exchange. And this figure should double up by 1980-81, at the current prices. But the world demand for molasses seems to be going down. In many countries e.g. Japan, the demand for control of pollution is forcing the distilleries to close down and such countries are importing more alcohol rather than molasses and paying attractive prices for it. By this change over, there is another advantage and that is a saving in transport requirements by about two-third. This aspect is all the more important

for a country like Pakistan whose transport and port facilities are already over burdened. Thus the export of molasses has to be re-examined from a number of angles and it seems that the country has to equip itself for the change over at the fastest possible speed. The total increase in foreign exchange earning/saving for 200,000 tons of molasses, after conversion into alcohol would be roughly estimated as:-

a)	Price per ton of molasses F.O.B. Karachi	= U.S.$ 36.00
b)	Price per ton of alcohol F.O.B. Karachi	= $ 200.00
c)	Income from export of alcohol derived from one ton of molasses	= $ 44.40
	(Assuming that about 4.5 tons of molasses yield one ton of alcohol or 275 gallons)	
	Increase in earning by export of industrial alcohol instead of molasses F.O.B. Karachi	= $ 8.44 per ton of molasses.
	Total increase in foreign exchange earnings on export of 200,000 tons of molasses	= $ 1,688,000.00
	(Prices quoted above are as of 3rd Feb., 1977)	

Export of industrial alcohol made from the fermentation of cane molasses was difficult to export for many years in the past because of competition from synthetic substitute, which has been produced as a by-product from petrochemical industry in large quantities and sold in the world market at cheaper rates. With the changed economic conditions of the petrochemical industires during the past few years, the industrial alcohol from molasses has regained importance in the world markets. Sale of industrial alcohol from the large quantity of surplus molasses available in Pakistan could become a much better source of foreign exchange earning than molasses. According to the calculations shown above, export of 400,000 tons of molasses, expected to be available around 1980-81, could fetch Rs. 14.4 crores

in foreign exchange F.O.B. Karachi, but when converted into industrial alcohol the same quantity would be worth Rs. 17.78 crores or a net gain of Rs. 3.38 crores per annum after taking into account the interest and depreciation charges on account of the new machinery installed for distillation.

Projects for the manufacture of yeast and citric acid have received the consideration of the Government from time to time. In countries with large portion deficiency, such as Pakistan, food yeast should be an important product. In Taiwan, food yeast has been manufactured for general consumption, especially as sugar coated yeast tables for school children. It also appears very desireable that Pakistan should have had a plant for Baker's yeast especially when Pakistan has embarked upon a project of large-scale baking of Nans/Rotis in big cities. It is understood that the Board of Industrial Management has been successful in establishing such a plant at Lahore with a production capacity of 900 tons per annum as against Pakistan's own estimated requirement of 230 tons or so. Perhaps it will be possible to use balance of the production capacity for export to R.C.D. Countries, Ceylon and Middle Eastern Muslim States. The production of food yeast is similar to that of Baker's yeast. The plant at Lahore could perhaps be partly used for manufacture of food yeast as a part of school children Health Programme.

The manufacture of citric acid has not yet been taken up in Pakistan. The country's requirements are estimated at 1000 tons p.a. whereas the minimum economic size of the plant is stated to be 3000 tons. Here again collaboration with R.C.D. Countries or manufacture with the assistance of Islamic Development Bank for supply to all the needy member countries of the Bank could perhaps be examined.

As stated earlier, Pakistan is expected to have large surplus of bagasse from its sugar factories and the quantity could be raised to about 1.5 million tons around 1980-81, if all the sugar mills were linked up with gas pipelines. This by-product is a good source of cellulose, which is the base for many important products required all over the world in large quantities such as paper, board, newsprint, man-made fibres, explosives, and various types of plastic materials. The cellulose requirements of the world industries were hitherto being met by the forest resources which are dwindling day by day. At the same time demand for cellulose is on the increase. Thus a country like Pakistan, which has relatively small forest wealth but a lot of sugar cane, can make use of the cellulose out of its bagasse for many kinds of industries. A plant has already been established at Charsadda (NWFP) for the manufacture of 30,000 tons of writing paper per year and another plant is working to full capacity at Lyallpur for the manufacture of hardboard (9000 tons) and particle board (4500 tons) per year. It is understood that Government has also had a project prepared for setting up a plant at Kamalia (Sargodha Division) for the manufacture of 30,000 tons of newsprint per year on the import of which Pakistan would be spending anything like Rs.20 crores every year. Prices of all kinds of paper, including newsprint, seem to be at the time on the increase because of international shortage of wood pulp. Pakistan Government are therefore actively considering establishment of two more projects for the manufacture of superior quality paper. It should be worth while examining the establishment of a large sized plant for the manufacture of paper for export on the basis of bagasse supplied by a number of sugar mills within a radius of say 30-40 miles. Manufacture of resins and furfural should also receive consideration.

It will be seen from the proceeding paragraphs that the two main by-

products of the sugar industry alone can increase the foreign exchange earnings or save expenditure in foreign exchange on import of essential items like writing paper, newsprint etc. It is perhaps desirable at this stage that the use of these raw materials for satisfying the requirements of not only Pakistan but some other friendly countries should be re-examined in the light of developments in the Petro-chemical industries. It may be possible to set up plants for man made fibres, resins, citric acid etc. With increase in foreign exchange earnings/savings as a result of better utilization of these by-products, it may be possible for Pakistan to face greater competition in the export of sugar should its price in the world market crash at any stage which is indeed hardly possible in the foreseeable future.

CHAPTER IX

PROSPECTS OF EXPORT OF SUGAR

Until a few years ago, most of the sugar sold in the international market (free world) was supported by pricing arrangements guaranteed by the British Common-Wealth Sugar Agreement and the U.S.A. Sugar Act. Only about 10% of the international free world sales used to be outside these arrangements. The prices of freely traded sugar were always lower than the prices payable under the arrangements and touched a record low level of about $ 70 per metric ton during 1965-68 against prices ranging between $ 30 and 40 paid for sales under those arrangements. During that period, the world production of sugar was far in excess of the demand and the carry-over was seldom less than 25% of the world demand. As a result, the world market prices were far below the average costs of production of even the efficient and low cost exporting countries. This naturally caused neglect of sugar industry in several exporting countries and discouraged further investment in this industry.

Since the beginning of this decade the supply demand equalibrium of the sixties has taken a drastic turn. By 1969, world consumption had almost caught up the world production and soon the consumption outstripped the total non-Socialist world production as will be observed from the following figures:-

Table XXIII

World Consumption & Production of Sugar

(in millions of metric tons - raw equivalent)

Year	Production	Consumption
1960*	49.00	47.10
1965*	64.50	57.30
1970*	71.00	70.20
1971*	70.30	71.80
1972*	71.20	73.55
1973*	74.80	76.38
1974*	80.50	80.21
1975+	82.00	81.00

Source: *page 47, (replacement bottom) - sugar world supply & distribution - US Dept. of Agr. Statistical Bulletin No. 562.

+page 70 "Food Engineering" of January 1977, RANDOR (USA)

There has been an annual increase of about 2 million metric tons in the world demand of sugar. But the consumption remained almost stationary for a number of years during early seventies. This was mainly attributable to consumer resistance against sharp rise in prices; and introduction of cheaper artificial sweeteners in advanced countries e.g. USA, Europe.

The above significant changes in supply demand position paved the way for a big boom in the world sugar prices. By 1970, the open market price was around $ 85 per metric ton. Since then it never went below that figure; in fact it continued to rise for a long time and, at times, soared to very high levels as shown in Table XXIV below:-

Table XXIV

London Market Prices of Refined Sugar
(As quoted in London Market WEEKLY REPORTS by Wood-house Drake & Carey Ltd. in their issues of dates shown below each quotation)

Period	Maximum Price	Minimum Price
	(All Prices in LDP ¢ per L.T.)	
1. Jan.-March 1974	260.00 (26.2.74)	147.00 (8.1.74)
2. April-June 1974	254.00 (26.2.74)	205.00 (2.4.74)
3. July-Sept. 1974	360.00 (3.9.74)	232.00 (2.7.74)
4. Oct.-Dec. 1974	605.00 (19.11.74)	365.00 (1.10.74)
5. Jan.-March 1975	435.00 (7.1.75)	240.00 (25.3.75)
6. April-June 1975	250.00 (18.4.75)	128.00 (20.6.75)
7. July-Sept. 1975	230.00 (15.8.75)	150.00 (4.7.75)

Table contd....

8.	Oct.-Dec.	1975	180.00 (7.11.75)	165.00 (5.12.75)
9.	Jan.-March	1976	196.00 (19.3.76)	175.00 (6.2.76)
10.	April-June	1976	199.00 (18.6.76)	180.00 (6.2.76)
11.	July-Sep.	1976	217.00 (9.7.76)	150.00 (24.9.76)
12.	Oct.-Dec.	1976	160.00 (15.10.76)	147.00 (10.12.76)
			M.T. FOBS	
13.	Jan.-March	1977	152.00 (21.1.77)	133.00 (7.1.77)

For about 9-10 months of 1974-75 the international price of refined sugar ruled over US $ 680 per metric ton, and for some time towards the end of 1974 it exceeded $ 1100. The beet harvest of Europe was extremely good that year and produced larger supplies. That, coupled with consumer resistance to higher prices of suger was responsible for setting forth a downward trend in the middle of 1975. Since then the prices have been going up and down frequently. During the past few months, they have touched very low level, as compared to the 1974 and 1975 prices but they continue to be far above the level of the sixties. Now it is almost certain that the price of sugar in the international market will remain unstable for many years to come but never go down to the level of sixties.

It is estimated by prominent international trading houses that the world demand will continue to rise at about the normal 2 million tons a year and reach a figure of 100 million by 1985 despite the prevailing price trend. The U.S. and British Agreements, which have already expired in December 1974, appear to have no chance of renewal. Any international sugar agreement appears to be out of the question in the foreseeable future, since it is

generally felt that such supply management programmes cannot stabilize prices under the prevailing trends.

This price trend has stimulated keen interest in many sugar producing countries for all out efforts to increase production. Mr. Sexton Tate of Tate & Lyle Ltd., of U.K. has recently stated that the engineering division of his company "had never been busier". It is well known in the international sugar market circles that major expansion will take place in the production of sugar in the coming years in Yugoslavia, Poland, Mexico, Brazil, Sudan, Morocco, Pakistan, India, Phillipines and Indonesia. Simultaneously, production and marketing of high-fructose sweeteners has received lot of attention in the developed countries, particularly the U.S.A. However, the planned increase of world sugar production as well as of artificial sweeteners will be unable to influence in any significant manner the price of sugar in the international market at least during the next decade or so. Of course, it does not mean that the price should stabilize say around U.S. $ 600 per ton or so. It is also felt that the peak of 1974-75 may not be touched again for many years to come, if at all it ever happens again. After all sugar production depends on weather conditions. Too little or too much rain (water) can affect sugar output dramatically everywhere in the world. The competitive market system is working in the sugar industry. The prices are bound to be influenced by the production in a particular year and surpluses traded in the international market in that year. In the 1976 Year Book of Sugar Journal six top leaders of the sugar world have expressed their views on "what direction should the sugar industry take". There seems to be consensus of opinion that "there is dire need to vigorously expand, in both field and factory, the total production of sugar in order to meet the ever growing consumption demand. Otherwise by 1980, a critical world shortage of sugar

would develop". These developments have stimulated many new countries to spare their production of sugar for the world market. For instance, India earned only U.S. $ 33 million in 1970-71, which was only 6% of that country's agricultural export earnings. That figure rose to $ 558 million in the year 1975-76 and accounted for about one-third of their agricultural exports*. Luckily Pakistan is very favourably placed for taking advantage of the big boom that is expected to continue in the international sugar market in the foreseeable future. As already pointed out in Chapter V, Pakistan stands to a surplus production of about 700,000 tons of refined white sugar per year when (by 1980-81) the existing 27 mills would have been balanced and modernized, ten new mills on order would have gone into commercial production and the cane departments of the sugar mills would be actively pursuing their expanded functions. And this could be possible with the existing resources of water and land under the sugar cane crop and without diverting any more of those resources to this crop. But it must be emphasised yet again that the production targets in the field will have to be achieved, and for that, both the mills as well as the growers will have to work hard with mutual understanding and cooperation. Besides, it must be clearly understood that the mills have to accept responsibility for achieving targets of per acre inputs as well as per acre yields of sugar. The mills must be made accountable to the country for this purpose.

It has also been stated in Chapter V that the ex-mill price of sugar has been fixed by the Government at Rs. 160/- per maund in the case of old mills and Rs. 170/- in the case of mills which have recently gone into production. After deducting the taxes and the profit margin of the mill from the average of these two figures the balance works out to Rs. 105.70 or Rs.2875.04, or say U.S. $ 290.00 per ton. It has already been shown on the same page that

* See page 6, "Foreign Agriculture" dated May 9, 1977.

after the recommended improvements in the cultivation and harvesting of sugar cane have been put into practice, the cost of cane required to produce one maund of sugar will be reduced to Rs. 61.2. The total cost of production of sugar will be reduced to Rs. 99.85 per maund approx. or US. $ 272 per ton, and the economic cost will be around U.S. $ 225 per ton.

The picture would, however, change when (i) each of the existing 27 mills would have been raised to 2750 tons per day crushing capacity (as recommended by the F.A.O. Mission of 1973-74) and (ii) ten new mills that are on order in the public sector would have also come into production. Then the cost of production could be assumed to be Rs. 117.79 and Rs.117.87 respectively. As against these figures, the National cost of white refined sugar would work out to Rs. 100.93 per maund or about Rs. 2750 or US. $ 275 per ton.

The above figures show that Pakistan can afford to enter the export market when the world sugar prices are higher than U.S. $ 300.00 per ton F.O.B. London ($ 275 + $ 25 on account of freight etc.). And if the prices rule still higher it will be quite profitable to sell abroad.

Table XXIV and subsequent discussion show that the international price of sugar will continue to fluctuate and there will be periods when the prices in the international market may be much higher than the economic cost of production of Pakistan's surplus sugar plus the cost of delivering it abroad. Pakistan should therefore hold on to its surplus production till a favourable price is offered to it*. Luckily, Pakistan has

* When finalizing this "Study" in August 1977, the author came across the following paragraph on page 6 of "Foreign Agriculture" (of U.S. Deptt. of Agr.) dated May 9,1977: "The sugar industry (of India) has urged the Government to adopt an "integrated and coordinated" sugar policy to step up production, maintain price stability, maximize exports when prices are high, increase the minimum price paid by the mills - currently just under one cent per Kilogramme - and reduce the excise duty on free sale sugar".

sufficient storage accommodation in the sugar mills for maintaining stocks for export. Thus it should not be difficult for Pakistan to sell abroad its 2 lac tons of surplus sugar every year at prices which should yield attractive profits. And if the proposals made in Chapter VII are implemented the surplus of exportable sugar in the country will go on increasing and so will the foreign exchange earnings.

It would be interesting to compare the net return per acre to Pakistan by the export of Cotton and Sugar. Annexure XI contains year-wise statistics of export of raw cotton, value & price per bale, as compiled by the C.S.O. and released by the Cotton Board of the Government of Pakistan. The average price per bale of 400 lbs of the last three years (1973-76) works out to Rs. 1537 (the average price of 1975-76 was Rs. 1481 and that of 1974-75 was Rs. 1311 only). If it is presumed that roughly speaking per acre yyield of lint was 5 maunds (say 400 lbs or one bale) and that in addition, there was export per acre of 10 maunds of cotton seeds @ Rs. 50 per maund, the total receipts per acre of cotton F.O.B. Karachi should be of the order of Rs.2000.00. Since cotton is a crop of about six months, export of sugar should earn more than twice that amount or over Rs.4000/- per acre to be more remunerative than cotton.

Now let us work out the price of sugar F.O.B. Karachi which should fetch Rs. 4200.00 per acre. This may be done for various stages of development of the sugar industry in the following table :-

Table XXV

F.O.B. Price of Sugar Required to Compare with Export of Cotton

	I	II	III
1. Cane yield per acre (ton)	15.0	20	25.0
2. Recovery in the mill (%)	8.5	9.0	9.5

Table Contd.....

		I	II	III
3.	Sugar made per acre (tons)	1.275	1.8	2.4
	(maunds)	34.68	48.96	65.28
4.	Earnings reqd. at mill per acre (Rs.)	4,200.00	4,200.00	4,200.00
5.	Add freight @ Rs.5.00 per maund (Rs.)	173.4	244.80	326.40
6.	Price required F.O.B. Karachi (Rs.) per acre production of sugar.	4,373.4	4,444.8	4,526.4
7.	Price required F.O.B. Karachi (Rs.) per maund of sugar.	126.2	90.78	69.34
8.	Price required F.O.B. Karachi (Rs.)	3,430.11	2,466.33	1,866.00
	per ton of sugar. (U.S. $.)	340.00	245.00	187.00

The above Table XXV shows that if Pakistan's sugar industry, including its agricultural production, continues to be as bad as it is today, it can be more profitable than cotton if the export price is over U.S. $ 340.00 per ton F.O.B. Karachi. But if the efficiency of the sugar industry develops even half as much as has been visualized in this "study" the price required should be around $ 245.00 per ton. and if sugar production in Pakistan really grows on healthy lines and achieves the targets recommended in this "study", the country should be making much better impact on foreign exchange earnings than cotton even when price for export is less than U.S. $ 200.00 F.O.B. Karachi. It should be remembered that those figures have been arrived at without taking into consideration the additional income per acre of sugar cane from the by-products while credit has been taken (in foreign exchange) for sale of cotton seeds produced per acre when calculating foreign exchange earnings per acre of cotton.

As pointed out earlier, the price of sugar is bound to fluctuate by wide margins during the next decade or so. Pakistan has plenty of storage accommodation to keep its surplus of 200,000 tons of refined sugar per year till such time as the export price (F.O.B. Karachi) rules near about say U.S. $ 350.00. From the point of view of Pakistan's cost of production, U.S.$ 340.00

per ton F.O.B. Karachi, is a very satisfactory price. Thus selling Pakistan surplus sugar at around U.S. $ 350.00 per ton F.O.B. Karachi will add handsomely to its earnings of foreign exchange as well as to its income per acre as compared to cotton.

In view of the above mentioned considerations it is considered that at present Pakistan should be satisfied with the production capacity of "White refined" sugar consisting of combined production capacity of the existing 27 mills, after their B.M.R, plus the ten new mills on order. Further expansion should be confined to wholly mechanized MINI SUGAR MILLS manufactured by the small engineering units around Gujranwala etc. Such units should preferably be set up as parts of the proposed cooperatives under the newly introduced legislation of cooperative farming. The production of these units should be reserved for domestic consumption, preferably in the areas covered by the cooperative societies concerned or around such societies, to save investment on transport etc. The entire production of white sugar may be pooled and it may be highly priced for domestic consumption to reduce its internal off-take and thereby save maximum possible quantity for export as and when prices in the international market are attractive. It is obvious that addition of large sized mills at the prevailing cost of about Rs.30.00 crores per mill of 2,000 tons crushing capacity will go on raising the cost of production and also the pooled per unit price of country's total production of "white refined" sugar. It is therefore, recommended that further additions to large sized units for manufacturing white sugar should be considered only after watching the prices of other countries engaged at present on large scale expansion programmes for international trading. If their prices are also rising with their increasing production for exports, Pakistan may consider adding to its strength of large sized "modern sugar

mills", PROVIDED the proposal made earlier for concentration on locally fabricated MINI SUGAR MILLS does not become popular or effectively helpful to the sugar economy of the country.

CHAPTER X

SUMMARY OF CONCOUSIONS AND RECOMMENDATIONS

Pakistan is the fourth largest producer of sugar cane in the World, but its average yield both of sugar cane and sugar are almost the lowest in the World.

There is very little being done to improve the yields. The staff and facilities available for research and extension work for the sugar-cane crop are far from being adequate.

The setting up of an autonomous National Sugar cane Institute/Committee should not be delayed any further. It should be liberally financed to develop its programme of work at a fast rate.

Sugar cane is the most paying crop for the grower, especially when he can sell the cane to a sugar mill at the prices fixed by the Government.

Average cost of growing one maund of sugar cane seems to be about Rs. 4.12 per maund under the present conditions and to the nation it costs Rs. 4.25 per maund.

A system of linking price of sugar cane to its sugar content should be evolved at the earliest possible date. In the meantime, the sugar factories should help themselves by helping the growers in obtaining better yields, and for that purpose partly invest in technically trained manpower for specialized extension work in the cane zones, and also ensure availability of credit to the grower at the right time, in cash or kind, directly or indirectly, for the required inputs and harvesting and transport of the cane crop.

Sugar mills should be made to expand their Cane Departments with a view to carrying out the same kind of intensive extension work as is under-

taken by large Cane Plantations for getting the right qualities of cane in the quantities required for keeping the mills working all the year on sound economic lines. This will include maintenance of efficient extension service specialized in sugar cane, supply of inputs, (in cash or kind) and maintenance of Tractor Farms to help growers in deep ploughing etc, and in planned harvesting of the crop.

The total additional credit requirements of expanded Cane Departments for 37 sugar mills is estimated at [illegible] per year.

As a result of Cane Department's expanded activities, the income of the grower should improve by over 300% over the income estimates as shown is Annexure I of this "Study". The profit of the sugar mills would increase by about Rs. 7.50 crores. There would be a substantial increase in the amount of excise duty to be collected as a result of increased sugar production in the sugar mills, if the excise duty is levied on actual annual production basis.

Another good result of the expanded activity of Cane Departments will be that sugar cane requirements of the 37 mills expected to be in full operation by 1980 will be met by about 37% of th present day acreage occupied by sugar cane. Thus it should not be necessary to divert any additional acreage to sugar cane crop to feed all the 37 mills expected to be in production before 1980-81.

The sugar beet crop is more profitable to the grower as well as to the mills than even sugar-cane. The climate of the NWFP is very suitable for growing this crop. Every effort should be made to obtain production of about 50,000 tons of sugar from beet in the four mills of N.W.F.P. which are already equipped for processing beet. The mills should be made responsible

for extension work and inputs, including credit, as for sugar cane.

Development of SORGUM, particularly to feed the sugar mills in the Punjab and Sind, should be vigorously pursued so as to reach a stage of obtaining an economic return by the crushing of that crop in the sugar mills.

Projections of sugar demand of Pakistan made by the F.A.O. in 1973-74, have been accepted by the Government. All efforts should be made to reach the production levels recommended in this "Study". It should be possible for the country to produce out of its existing 27 mills about one million tons of white sugar and 1.5 million tons of equivalent in the form of gur and shakkar.

The F.A.O. Mission has suggested B.M. & R. of 24 sugar mills out of the 27 mills already installed at a cost of Rs.43.00 crores. This should raise the present crushing capacity (44,400 tons) by about 20,550 tons to 64,950 tons per day of 24 hours. That should enable production of about 8.8 lac tons of white sugar per year even if recovery continues to be 8.5% and working season is of 160 days. This recommendation should be implemented in the shortest possible time.

The capital cost of raising the production capacity of the 27 mills will work out to Rs. 21,000 per ton of crushing capacity as against Rs.130,000 approximately per ton of the cost of ten new mills ordered in the Public sector by Pakistan.

The details of B.M. & R of the 24 existing mills as suggested by the F.A.O. Report, should be re-examined by a team of experts drawn from amongst the senior members of Pakistan Sugar Technologists Association and the financing institutions with a view to using maximum amount of the machinery

and equipment made within Pakistan.

When examining the B.M. & E. requirements of the existing sugar mills, the proposed team of experts should also examine how the production process of each mill can be changed so as to reduce its cost of production and to discard the O.C.D.S.

The addition of ten new sugar mills on order will raise the production capacity of Pakistan by about 2.5 lac tons per year if recovery continues to be 8.5% and working season is of 160 days. This will go up to 2.45 lac tons when recovery rises to 9.6% and working season is reduced to 150 days.

By 1980-81, when the efforts of the Cane Departments should be successful to raise the recovery to 9.6% and yield per acre to 25 tons, the existing 27 mills would have been balanced and modernized and the ten new mills would have gone into commercial production, the total annual production of white refined sugar should be about 1.2 million tons.

By 1980-81 Pakistan should be able to spare about TWO lac tons of its production of refined sugar for export. The quantity could be increased by a suitable price mechanism and by accelerating the establishment of MINI SUGAR MILLS.

Excluding excise duty and the margin of profit of the mills, the present day average cost of production of refined sugar has been worked out by the Government as Rs. 105.70 per maund ex-mill or U.S. $ 290.00 per ton. By 1980-81, when cane would have improved to the desired level, the average cost of the 27 existing mills should go down to Rs. 99.85 per maund or U.S. $ 275.00 per ton, after paying Rs. 61.20 (Sixty-one and paisa twenty only) for purchase of cane required per maund of sugar. But the National cost of

production of sugar will be about Rs. 82.94 per maund or say U.S.$ 225.00 per ton, after paying Rs. 44.285 for the cane consumed in making one maund of refined sugar.

By 1980-81, after the ten new mills have come into commercial production and the existing 27 mills had their B.M. & R. at a cost of Rs. 45.00 crores and the sugar cane would have developed to give 25 tons per acre and 9.6% recovery in the mill, the combined average cost of production should be Rs. 117.87 per maund or U.S. $ 321.00 per ton. But the national cost should be about Rs. 100.93 per maund or say U.S. $ 273.00 per ton.

The prices of sugar in the international market were extremely low during 1965-68,------- at times lower than the average costs of production of even the efficient and low cost exporting countries. This discouraged further investment in sugar industry. As a result the supply demand equilibrium of sixties was drastically upset. World consumption soon exceed production. Prices, therefore, started rising and by December, 1974, touched a record level of U.S. $ 1100.00 per long ton approx. Since then the prices have been going up and down but have never gone near the level of sixties nor the peak of December, 1974.

The price spiral of early seventies has stimulated many sugar producing countries for all out efforts to increase production. Many new countries have also started sparing their production of sugar for export.

The price of sugar in the international market will continue to fluctuate for many years to come and there will be periods when those prices will be much higher than the economic cost of production of Pakistan's sugar plus the cost of delivering it abroad.

The surplus of Pakistan's sugar production - about 2 lac tons per year - should be kept in the storage accommodation of the sugar mills and

sold abroad when the prices are about say U.S.$ 350.00 per ton. Pakistan should thus be able to add handsomely to its annual foreign exchange earnings. This income per acre in foreign exchange will be more than the income from export of cotton.

Cottage based sugar industry consumes nearly 50% of the cane crop per year these days. It has played a dominant role in the supply of sugar in Pakistan. But this industry suffers from inefficiency at every stage and throws down the drain sugar worth Rs. 120.00 crores approximately every year.

Gur making must be replaced by wholly mechanized sugar extraction units. In view of the high capital cost of installing "modern refined white sugar making factories" the average cost of production of sugar is bound to go up with increase in the number of such units. An alternative method has to be found. In the meantime the process of gur making should be improved and developed as far as possible to reduce loss of sugar produced in the fields.

It will be quicker and far more economical method of replacing gur making to encourage the setting up of MINI SUGAR MILLS OF 150 to 500 tons per day crushing capacity. These can be wholly made within Pakistan by small engineering houses around Gujranwala. Each mill of 500 tons per day capacity will cost roughly Rs. 2.75 crores, including cost of locally made boilers, imported stainless steel tubes and all the civil works. This cost works out to Rs. 55,000 per ton of crushing capacity as against Rs. 130,000 for a new large modern mill of refined sugar. These mills will recover about 8% of sugar as against 5% recovered in gur making, thus leading to a saving of sugar worth Rs. 65.00 lacs every year per mill of 500 ton crushing capacity. Such MINI SUGAR MILLS should be developed as quickly as possible.

The MINI sugar mills should preferably be installed as components of the agricultural cooperative farming societies. In any case these mills should be given every possible assistance by the Government and preferential treatment in respect of taxation as compared to large modern mills.

Greater attention should be paid to development of industries for manufacture of by-products of sugar cane processing industry. In particular, export of industrial alcohol rather than molasses and manufacture of paper, newsprint and boards out of bagasse should receive immediate attnetion.

List of Annexures

ANNEXURE 1

COST OF PRODUCTION OF SUGAR CANE (Plant)
CROP UNDER AVERAGE RESOURCES (1975-76)

S.No.	Name of the Operation	No./Amount	Rate/Unit	Total Expenses
1.	Preparatory Tillage.			
	i) Ploughing	6	18.00	108.00
	ii) Planking	4	4.50	18.00
2.	Seed Bed Preparation			
	i) Ploughing	2	18.00	36.00
	ii) Planking	2	4.50	9.00
3.	Cost of Seed	80 mds.	5.75	460.00
4.	Sowing Operation			
	i) Sowing of sets	12m.day	8.00	
	ii) Ploughing	1	18.00	18.00
	iii) Bund Making	$\frac{1}{2}$ m. day	8.00	x 4.00
	iv) Ploughing and Planking	1	22.50	22.50
5.	Interculture			
	i) One blind Hoeing	8m.day	8.00	64.00
	ii) Three Hoeing with kassola	12m.day	8.00	96.00
6.	Manure & Fertilizer			
	i) F.Y.M.	10 cartload	20.00	200.00
	ii) Transport (2 men & 1 Bullock) Bullock pair m.day pair for 2 days+¼ m.day for spreading.		8.00	75.00
	iii) Urea	1 bag	75.00	75.00
	iv) Transport of 1 bag of Urea & its application=½ m.day		5.00	5.00
7.	Irrigation			
	i) Cleaning of water channels 2 m.day		8.00	16.00
	ii) Labour charges for 17 Irrig.	44 m. day	8.00	32.00
	iii) Water rates		35.00	35.00
8.	Plant Protection			
	i) Dimecron/Metosystex		9.20	9.20
	ii) Labour charges		8.00	16.00

S.No.	Name of the Operation	No./Amount	Rate/Unit	Total Expenses
9.	Harvesting stripping & Loading i) Harvesting & stripping in lieu of tops			-
	ii) Loading @ Rs.0.25/md. for 475 mds.			118.75
10.	Land Revenue & other taxes			14.00
11.	Intercast on investment @.12% for 1 year on seed, fertilizer & P.Protection i.e. Rs. 340/-p.a.)			100.82
12.	Management charges			51.72
13.	Risk coverage @ 1% p.a. on items 1-12 i.e. Rs.1649.31			16.60
14.	Total expenditure excluding land rent			1696.40
15.	Land Rent			600.00
16.	Marketing charges including transport & Octroi @ Rs.0.50/md. for 475 mds.			237.50
17.	Total cost of production of 475 mds. (item 14+15+16)			2533.75
18.	Cost of production of 1 md. of S.Cane			5.30
19.	Gross return (475 mds. x Rs.5.75)			2831.25
20.	Net return (item 19-17)			297.35

(SOURCE: Cane Botanist, Agr. Research Institute, Faisalabad)

ANNEXURE II

COST OF PRODUCTION OF SUGAR CANE(Ratoon)
CROP UNDER AVERAGE RESOURCES (1975-76:)

S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
1.	Ploughing in ratoon fields	2	18.00	36.00
2.	Hoeing with Kasola	8 m.day	8.00	64.00
3.	Fertilizer Urea	1 bag	75.00	75.00
	Transportation of 1 bag to its application.	1	1.00	1.00
4.	Irrigation			
	i) Clearing of water course	2 m.day	8.00	16.00
	ii) Labour charges for 16 Irrig.	1 m.day	8.00	32.00
	iii) Water rates			35.00
5.	Plant Protection			
	i) Dimecron			9.00
	ii) Labour charges	2 m.day	8.00	16.00
6.	Land revenue & other taxes			14.00
7.	Harvesting stripping & loading			
	i) Harvesting & stripping in lieu of tops			
	ii) Loading @ 0.25/md. for 325 mds.			81.25
8.	Interest on Investment @12% p.a. for 1 year on fertilizer & P.Protection i.e.Rs.105.70			12.60
9.	Management charges			51.72
				(443.57)
10.	Total expenditure (item 1-9)			443.57
11.	Risk coverage @ 1% p.a. for 1 year on items (1 - 10)			4.44
12.	Total expenditure net of rent			448.01
13.	Land Rent			600.00
14.	Marketing expenses @ Rs.0.50/md. for 325 mds. including transport, octroi & others			162.50
15.	Total cost of production of 325 mds. of cane (items 12+13+14)			1210.51

continued.....

S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
16.	Cost of production of 1 md. of cane.			3.72
17.	Gross return or 325 mds. @ Rs. 5.75/md.			1868.75
18.	Net return Item (17 - 15)			658.24
19.	Total net return from 2nd of ratoon crops.			955.59
20.	Average net return per acre per year from sugar cane (of 2 years cropping)			477.79

(SOURCE: Cane Botanist, Faisalabad)

APPENDIX III

COST OF PRODUCTION OF COTTON UNDER [illegible], (1975-1976)

S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
1.	Preparatory Tillage			
i)	Ploughing	5	18.00	90.00
ii)	Planking	2	4.50	9.00
2.	Seed Bed Preparation			
i)	Ploughing	1	18.00	18.00
ii)	Planking	1	4.50	4.50
iii)	Bund Making 2 men for ½ day i.e.	½ m.day	8.00	4.00
iv)	Sowing	½ m.day	8.00	4.00
3.	Interculture			
i)	Interculture	4 m.day	8.00	32.00
ii)	Thinning	2 m.day	8.00	16.00
4.	Seed	8 seers	60.00 (per md.)	12.00
5.	Irrigation			
i)	Cleaning of water courses	1 m.day	8.00	8.00
ii)	Irrigation Labour	1 m.day	8.00	8.00
iii)	Water rates		16.00	16.00
6.	Fertilizer			
i)	Urea	½ bag	75.00	37.50
ii)	DAP	½ bag	75.00	37.50
iii)	Transportation	1 bag	1.00	1.00
iv)	Cost of application	½ m.day	8.00	4.00
7.	Plant Protection			
i)	Dusting with BHC	20 lbs.	0.53	10.60
ii)	Spray with Thiodan	2 lbs.	5.25	10.50
iii)	Labour charges	1 m.day	8.00	8.00

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S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
8.	Picking charges			
i)	1/16th of 10 mds.	25 seers	100.00/md.	62.50
ii)	Harvesting of sticks	2 m.day	8.00	16.00
9.	Land revenue & other taxes		15.00	15.00
10.	Interest on investment @ 12% p.a. on seed fertilizer & plant protection(i.e.Rs.121.10)			14.52
11.	Management charges			38.79
12.	Total expenditure (item 1 - 11)			476.91
13.	Risk coverage @ 5% over 3 years i.e. 1.67% p.a. for 9 months on Rs. 476.91			5.97
14.	Total expenditure net of rent			482.88
15.	Land rent			400.00
16.	Total expenditure with land rent			882.88
17.	Value of sticks 12 mds. @ Rs. 4/- per md.			48.00
18.	Cost of production of 10½ mds. of seed cotton item (16 - 17)			834.88
19.	Cost of production of one maund of seed cotton.			79.51
20.	Marketing charges @ Rs. 2.50 per md.			26.25
21.	Total cost of production of 10½ mds. of seed cotton in the market (item 18+20)			861.13
22.	Cost of production of one md. of seed cotton (in mandi)			82.01
23.	Gross return per acre:			
i)	Seed cotton	10½ mds.	85.00	892.50
ii)	Sticks	12 mds.	4.00	48.00
iii)	Total			940.50
24.	Net return per acre (item 23-21)			+ 78.37

(SOURCE: Cane Botanist, Agr. Research Institute, Faisalabad)

ANNEXURE IV

COST OF PRODUCTION OF WHEAT UNDER AVERAGE RESOURCES (1975 - 76)

S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
1.	Preparatory Tillage			
	i) Ploughing	4	18.00	72.00
	ii) Planking/levelling	2	4.50	9.00
2.	Seed Bed preparations			
	i) Ploughing	2	18.00	36.00
	ii) Planking	1	4.50	4.50
3.	Sowing			
	i) Ploughing, for sowing	1	18.00	18.00
	ii) Planking	1	4.50	4.50
4.	Seed	1 md.	40.00	40.00
5.	Bund Making ¼ day for 2 men i.e. ½ m.day		8.00	4.00
6.	Manure & Fertilizer			
	i) Urea	1 bag	75.00	75.00
	ii) Transportation	1 bag	1.00	1.00
	iii) Application cost (2 appli)	½ m.day	8.00	4.00
7.	Irrigation			
	i) Cleaning of water courses	½ m.day	8.00	4.00
	ii) Labour charges for 5 irrig.	1¼ m.day	8.00	10.00
	iii) Water rates		10.60	10.60
8.	Interculture	1 m.day	8.00	8.00
9.	Harvesting (2 mds/acre-cost of grains & bhoosa)	2 mds.	37.00	74.00
10.	Threshing			
	i) 2 pairs of Bullocks		18.00	36.00
	ii) 2 men for one day		8.00	16.00
11.	Winnowing (2 srs. per md. for 20 mds.	40 seers	37.00	37.00
12.	Land revenue & other taxes			14.00
13.	Interest on investment @ 12% for 6 months on seed & fertilizer.			7.20

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S.No.	Name of Operation	No./Amount	Unit/Rate	Total Expenses
14.	Managerial cost one Manager for 150 acres & 116% cropping intensity @ 750/- p.m.			25.86
15.	Risk coverage charges @ 0.5% on total investment item (1-14) for 6 months i.e. Rs.511.36			1.28
16.	Total cost net of rent			512.64
17.	Land rent			300.00
18.	Total cost including land rent			812.64
19.	Value of wheat Bhoosa	20 mds.	@ Rs.6/md.	120.00
20.	Total cost of production of 20 mds. of wheat grains at farm gate.			692.64
21.	Marketing charges @ Rs.1.70/md. for 20 mds. including transport & octroi charges/			34.00
22.	Cost of production of 20 mds. of wheat grain at Market.			658.64
23.	Cost of production of 1 md. of wheat at market place			32.93
24.	Gross returns (wheat 20 mds. @ Rs. 37/- = 740.00 + bhoosa 20 mds. @ Rs.6/- = 120.00)			860.00
25.	Net returns item (24-22)			+ 201.36

(SOURCE: Cane Botanist, Agr. Research Institute, Faisalabad)

ANNEXURE V

COST OF PRODUCTION OF RICE IRRI-6
UNDER AVERAGE RESOURCES (1975-76)

S.No.	Name of Operation	No./Amount	Unit/Rate	Total Expenses
1.	Preparatory Tillage			
i)	Ploughing	4	18.00	72.00
ii)	Planking	2	4.50	9.00
2.	Seed Bed preparation			
i)	Ploughing	2	18.00	36.00
ii)	Planking	1	4.50	4.50
3.	Raising of nursery			
i)	Cost of seed	5 seers	36.00	4.50
ii)	Preparation of nursery bed & sowing	1 m.day	8.00	8.00
iii)	Cost of manure & its application	½ C.L.	20.00	12.00
iv)	Pesticides for nursery & its appli:		5.00	2.00
v)	Irrigation	4		
4.	Transplanting of nursery			
i)	Uprooting of nursery	1 m.day	8.00	8.00
ii)	Transporting of nursery	½ m.day	8.00	4.00
iii)	Transplanting charges	4 m.day	8.00	32.00
5.	Fertilizer:			
i)	Urea	½ bag	75.00	37.50
ii)	D.A.P	½ bag	75.00	37.50
iii)	Transportation & appli:		5.00	5.00
6.	Irrigations:			
i)	Cleaning of waterchannels	1 m.day	8.00	8.00
ii)	Labour charges for 16 Irrig.	4 m.day	8.00	32.00
iii)	Water rates		16.00	16.00
7.	Weeding	4 m.day	8.00	32.00
8.	Plant protection cost			
i)	Diazinon Granules	10 lbs.	1.30	13.00
ii)	Labour charges	½ mds.	8.00	4.00

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S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
9.	Harvesting & Threshing Harvesting, Threshing & Cleaning	3.00mds.	26.00	78.00
10.	Land Revenue & other taxes		16.86	16.86
11.	Interest on Investment @ 12% for 6 months seed, Fertizer & P. Protection i.e. Rs.128.50			7.71
12.	Management charges			25.86
13.	Total expenditure (item 1-12)			516.49
14.	Risk coverage @ 5% for 5 years i.e. 1% per annum on Rs.516.49			2.53
15.	Total cost net of rent			519.02
16.	Rent of Land			300.00
17.	Total cost including land rent			819.02
18.	Marketing charges @ 1.68/md. for 30.0 mds.			50.40
19.	Value of straw @ 1.68/md. for 30.0 mds.			50.40
20.	Total expenditure of production per acre (item 17+18)			869.42
21.	Total cost production of 30 mds. of Irri. paddy in the market (item 17+18-19)			819.42
22.	Cost of production of 1 md. of paddy			27.30
23.	Gross returns i) 30 mds. of paddy @ 27/- ii) 30 mds. of parali @ 5/-		810/- 150/-	960.00
24.	Net return (23 - 21)			140.98

(SOURCE: Cane Botanist, Agri. Research Institute Faisalabad)

ANNEXURE VI

COST OF PRODUCTION OF RICE (Basmati) UNDER AVERAGE RESOURCES (1975-1976)

S.No.	Name of Operation	No./Amount	Rate/Unit	Total Expenses
1.	Preparatory Tillage			
	i) Ploughing	6	18.00	108.00
	ii) Planking	4	4.50	18.00
2.	Nursery Charges (seed)			
	i) Seed	4 seers	60.00	6.00
	ii) Preparation of Nursery bed	1 m.day	8.00	8.00
	iii) Cost of manure	½ cartload	20.00	10.00
	iv) Cost of pesticides ½lb. + ½ m.day	1 appli:		4.50
	v) 4 Irrigation for nursery			2.00
3.	Transplanting cost.			
	i) Up-rooting of nursery	1 m.day	8.00	8.00
	ii) Transporting of nursery	½ m.day	8.00	4.00
	iii) Transplanting of nursery	4 m.day	8.00	32.00
4.	Fertilizer			
	i) Urea	1 bag	75.00	75.00
	ii) DAP	½ bag	75.00	37.50
	iii) Transportation of Fert:	1½ bag	1.00	1.50
	iv) Application	½ day	8.00	4.00
5.	Irrigation			
	i) Cleaning of water course	1 m.day	8.00	8.00
	ii) Labour charges for 16 Irrig.	4 m.day	8.00	32.00
	iii) Water rates		16.86	16.86
6.	Weeding	4 m.day	8.00	32.00
7.	Plant protection			
	i) Diazenon	10lbs.	1.30	13.00
	ii) Labour charges	½ m.day	8.00	4.00
8.	Harvesting & Cleaning			
	i) Harvesting, threshing & cleaning 4 seers per md. i.e. 72 srs. for 18 mds. of fine paddy	72 seers	45.00	81.00

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Sl.No.	Mode of Operation	No./Amount.	Rate/Unit	Total Expense
9.	Land Revenue & other taxes		14.00	V+.00
10.	Interest on Inacaia neat E 123 *for 6* months on seed, fertiliser & plant protection i.e. Rs.137.00			8.22
11.	Management charges			25.86
12.	Total Cost (1 - 11)			533.14
13.	Risk coverage @ 5% i.e. 1% p.m. for 6 months on items (1-12)			2.76
14.	Total cost net of rent (item 12+13)			556.20
15.	Land rent			300.00
16.	Total expenditure including land rent			856.20
17.	Value of paddy straw 18 mds. @ Rs5/md.			90.00
18.	Cost of production of 18 mds. of fine paddy (16-17)			766.20
19.	Marketing charges @ Rs.2.20/md. for 18 mds.			39.60
20.	Total cost of production of 18 mds. of paddy in the market (item 18+19)			805.80
21.	Cost of production 1 md. of F. paddy			44.76
22.	Gross returns per acre			
	i) 18 mds. of fine paddy @ (18x45.00=810.00)			900.00
	ii) 18 mds. of straw (18x5.00 = 90.00)			
23.	Net return per acre (items 22-20)			+ 94.20

(SOURCE: Cane Botanist, Agr. Research Institute Faisalabad)

COST OF PRODUCTION OF CROPS PER ACRE - 1975

ANNEXURE VII

OPERATIONS/INPUTS	WHEAT			COTTON			SUGAR-CANE		
	No./Qnty.	Rate in Rs.	Amount Rs.	No./Qnty.	Rate	Amount Rs.	No./Qnty.	Rate	Amount Rs.
1. Land Preparation:									
a) Preparatory Tillage									
Ploughing	3	21.00	63.00	3	21.00	63.00	4	21.00	84.00
			84.00			84.00			126.00
Clod crushing	1	21.00	21.00	1	21.00	21.00	2	21.00	42.00
b) Seed Bed Preparation									
Ploughing	2	21.00	42.00	2	21.00	42.00	2	21.00	42.00
			52.50			52.50			52.50
Planking	1	10.50	10.50	1	10.50	10.50			10.50
2. Seed	40 seers	37.50	37.50			24.00	80 mds.	5.90	472.00
3. Planting	2 men for ½ 1 pair days	7.00	14.00	2 men for ½ 1 pair days	7.00	14.00	12 men	7.00	84.00
4. Weeding/Hoeing/	-	-	-	6 men	7.00	42.00	33 men	7.00	273.00
				2 pair	14.00	28.00	2 pair	14.00	
						70.00			
5. Fertilizer Urea	1 bag	75.00		1 bag	75.00		2 bag	75.00	150.00
			150.00			150.00			225.00
DAP	1 bag	75.00		1	75.00		1 bag	75.00	75.00
6. Irrigation (including Maintenance of channels	2 men	7.00	14.00	4 men	7.00	28.00	10 men	7.00	70.00
7. Plant Protection	-	-	-	3 spraying	20.00	60.00			150.00

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OPERATIONS/INPUTS	WHEAT			COTTON			SUGAR - CANE		
	No./Qnty	Rate in Rs.	Amount Rs.	No./Qnty.	Rate	Amount Rs.	No./Qty.	Rate	Amount Rs.
8. Harvesting/Picking/Winnowing & Threshing	10 men	7.00	70.00	15 men	8.00/ md.	120.00	700 mds.	1.00	700.00
	4 pair	14.00	126/- 56.00						
9. Land Revenue	-	20.00	20.00		20.00	20.00		20.00	20.00
10. Rent of Land	-	50.00	50.00	-	50.00	50.00	-	50.00	50.00
11. Transportation to Mill	-	-	-	-	15.00	15.00	700.00	1.00	700.00
12. Miscellaneous	-	-	20.00	-	-	30.00	-	200.00	200.00

WHEAT

Yield = 22 mds. grain Total Cost 568.00
22 mds. bhoosa

Income 22.00x 37.50 = 825.00
22.00x 8.00 = 176.00
1001.00-588
= 433.00

COTTON

Yield=15mds.x100
= 1500
Income=1500-717.50
= Rs.782.80

Total
717.50
782.50

SUGAR-CANE

Yield=700mds.x5.90=4130.00
Income=4130-3122.50=1007.50
Rs. 1007.50

(SOURCE: Agr. Livestock & Fisheries Deptt, Government of Sind)

ANNEXURE VIII

COST OF PRODUCTION OF SUGAR CANE (PLANT) WHEN SUCROSE YIELD IS 9.6%, CANE YIELD IS 25 TONS PER ACRE AND INPUTS ARE AVAILABLE AT PRICES OF ANNEXURES I to VII, SUITABLY MODIFIED

S.No.	Nature of Operation	Unit	Cost (Rs)	Remarks
1.	Preparatory tillage	Acre	200.00	See Note (4). Ploughing by tractors will cost more than Rs.126 assumed in Annex I & VII.
2.	Seed Bed Preparation	-do-	45.00	As per Annex I.
3.	Cost of Seed	80 mds. @ Rs.6/md.	480.00	Price of Rs.6 per md. is charged because of better quality & chemically processed seed. Annex.I charges Rs.450.00 & Annex.VII charges Rs.472.00
4.	Sowing Operations	Acre	140.00	As per Annex. I.
5.	Interculture	-do-	160.00	-do-
6.	Fertilizers	Acre	350.00	Annex.I assumes Rs.350.00 Sind Govt. assumes this cost as Rs.225.00 for two bags of Urea & one bag of DAP(see Annex.VII)
7.	Irrigation	-do-	83.00	As per Annex I. But Annex.VII assumes Rs. 70.00
8.	Plant Protection	-do-	25.00	As per Annex.I. But the service is proposed free of cost completely. See Annex. IX.
9.	Harvesting & Stripping	-do-	Free, in lieu of tops.	
	Loading @Rs.0.25/md.	-do-	170.00	Rate assumed is as per Annex. I.
10.	Land Revenue & other Taxes	-do-	14.00	As per Annex. I.
11.	Interest for one year @12% p.a. on cost of items 1,3,6 & 8.(i.e. Rs.1055.00)	-do-	126.60	
12.	Management charges	Acre	50.00	As per Annex.I.
13.	Risk coverage @1% of items 1 to 12 (Rs.1843.0)	Acre	18.43	As per Annex. I.

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S.No.	Nature of Operation	Unit	Cost (Rs.)	Remarks
14.	Total Expenditure (excluding Land Rent)	Acre	1862.03	
15.	Land Rent	Acre	600.00	As per Annex. I Annex. VII assumes only Rs.50.00
16.	Marketing charges, Octroi & Transport @ Rs.0.50 per maund.		340.00	
17.	Total cost of production of 680 maunds.		[illegible] or say Rs.2800.00	Annex. VII works out Rs. [illegible] for a yield of 700 mds. to Rs. 3122.50.
18.	Cost of production of one maund of cane		4.12	
19.	Gross return @ 5.75 per md.		3910.00	
20.	Net return per acre (if quality premium is received).		1280.00	

II. Adding Rs. 92.00 to the above mentioned cost of production per acre (See para 14 ante) in lieu of SUBSIDY received by the grower from the Government on account of irrigation rates, plant protection measures and fertilizers, the NATIONAL cost of growing 680 maunds of cane in one acre will works out to Rs. 2894.00 only for Rs. 4.25 per maund of cane.

(x) of Annexure IX.

ANNEXURE IX

FINANCIAL EFFECT OF PROPOSALS MADE TO IMPROVE WORKING CONDITIONS OF SUGAR MILLS

ASSUMPTIONS:

(1) Crushing Season =150 days
(15th Nov. to 7th May=173 days
minus closures = 23 days

(2) Cane produced per acre in cane zone will be 25 tons or 680 maunds (average) and MILL RECOVERY will be 9.6%.

(3) Thus for a Mill of: 2,000 ton

a) Cane required per season 300,000 tons

b) Acreage required (including 15% for seeds etc.) 14,00

c) Sugar production: 28,800 tons
but presum 27,500 "

d) Price of cane: Rs.5.875 per maund, on average.
(Rs.5.75 per md. + 0.25 per maund, bonus on half the quantity purchased).

(4) Each Mill will provide credit or invest as under (per 2000 ton crushing capacity)

	ITE	CREDIT	INVESTMENT
I.	Supply of seed (For say 5,000 acres p.a. @ 80 mds. per acre.	Rs. 25 lacs	NIL, except for Extension staff provided under mill's Cane Department (See Note I)
II.	Supply of fertilizers	Rs. 25 lacs	NIL. See Note (2) below.
III.	..Plant Protection Assistance	NIL	Rs. 5.00 lacs See Note (3) below.
IV.	Land Preparation.	Rs.6.0 lacs. (Capital cost + cost of operations- cost of salaries & wages of employees of Tractor Farm.)	

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item		Credit	Investment
V.	Planning of Harvesting.	NIL	NIL. See Note (5) Already being done. For additional load of work please see item VI below.
VI.	Increase in Extension Staff.	NIL	Rs.4.00 lacs. See Note(6)
	Total:	Rs. 56.00 lacs	Rs. 15.00 lacs.

The above mentioned investment of Rs. 15.00 lacs will add Rs.2. per maund to the cost of sugar but there will be an equivalent reduction in annual depreciation on account of already installed machinery which has been fully depreciated. Therefore, no provision is made in the cost of production of 37 mills' production, on account of this investment.

VII.	B.M & R OF FACTORY as per F.A.O. Report.	NIL	Each mill cost about Rs. 2 crores. which will be depreciated over 20 years. It will work out to Rs.10 lacs per year plus interest of say Rs. 10 lacs p.a. = Rs.20 lacs. This will raise the cost of production by Rs. 26.74 per maund over and above the current rate of Dep. + Interest.
	The crushing capacity of mill goes up by about 750 tons per day.		

VIII. Ten(10) new mills costing Rs.225 crores and producing 2.45 lac tons of sugar p.a., depreciated over 20 years and paying interest over 20 years at an average rate of 10% p.a. on half the investment. This will cost Rs.33.76 per maund p.a. on account of Dep. + interest. When another ten (10) mills of the same size are added at a cost of Rs.300 crores, the annual cost per maund of sugar will have to include Rs.45.018 for 20 years, on account of depreciation plus interest.

NOTES:

NOTE (1) SEED - Total area to be covered each year will be 1/3 of 14.000 acres. the remaining will be ratoon crop or the seed will be provided by the

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the rest will be looked after by the well to do farmers themselves.

∴ Seed required = 5000 x 80 maunds

Cost of seed @ Rs.6 per md. = Rs. 24,00,000.00

Cost of transport = Rs. 100,000.00

Total credit required = Rs. 25,00,000.00

It is presumed that Mill Farm and Demonstration plots will work on no profit basis. Staff has been provided under item (6). See Note (5) below.

NOTE (2) FERTILISERS - Pressure growers of 10,000 acres (5,000 acres for Plant sowing and the balance 5,000 acres for Ratoon) will seek credit, and the rest will make their own arrangements at the rate of 2 bags of Urea, one of P and one of K or four bags per acre costing Rs.75 x 4 = Rs.300.00 for Plant crop and one bag of Urea and ½ bag of P plus ½ bag of K or two bags per acre costing Rs. 150.00 per acre of Ratoon.

Credit reqd. for Fresh crop	= Rs.5000x300 =	Rs. 15,00,000.00
Credit for Ratoon	= Rs.5000x150 =	Rs. 7,50,000.00
Add 10% for wastage and transport	= Rs.	2,50,000.00
TOTAL CREDIT REQD.		Rs. 25,00,000.00

NOTE (3) PLANT PROTECTION - Plant protection measures will be provided through the Mill Staff, by way of Liaison, by the Agr. Deptt.'s Plant Protection wing for large scale spraying, etc. In case of chemicals required for sprinkling or dusting the cane department of the mill will maintain stocks of the value of Rs. 5 lacs each season and distribute among the deserving growers free of cost.

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NOTE (4) TRACTOR FARM - The cane department will organize Tractor Farm of its own comprising 16 tractors of 45/50 HP each plus suitable implements for ploughing and planking. No other service will be provided during the sowing season. A small workshop will be maintained for looking after the tractors.

Cost of 1 tractor & 1 set of implements	Rs. 1 lac only
Cost of 16 tractors etc.	Rs. 16 lacs
Cost of spares @ 25%	Rs. 4 lacs
Cost of repair workshop & tools etc.	Rs. 4 lacs
Total Cost	Rs. 24 lacs
Depreciating @ 25%, capital cost per year	Rs. 6 lacs
Interest + cost of oil etc. per year	Rs. 6 lacs
Total cost of providing the tractor facility	Rs. 12 lacs per year

Each tractor will plough 4 acres a day of 8 hours. Working for 45 days in a season, the 16 tractors will cover an area of 16x4x45= 2,880 acres or say 3,000 acres a year.

If the personnel for operating the tractor farm is provided by the mill, then the rate of ploughing and planking will work out to Rs 12 lacs ÷ 3000=Rs 400 (as against bullock ploughing and planking for which Agr. Deptt. research station provides Rs 116.00 per acre). It is, therefore, provided that ½ of the cost should be subsidized by the mill and the rest recovered @ Rs 200 per acre from the grower.

NOTE - (5)

The existing staff employed in the Cane Department should be able to do the work aided by the additional field workers provided for below.

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NOTE ~ (6)

Str.fi required for tho above mentioned' in-puts and to be paid for by the mill is os under:-

I. TinCTOR F.dtM:

(a) Staff1	No.	Rate P.M.	Total p.a. (Rs)
Manager, Tractor Farm	1	Rs. 3,000/-	36,000.00
Asstt." " "	2	2,500/-	60,000.00
Machinery operators	16	600/-	1,29,600.00
Machinery " (leave reserve)	2		
Repair Mechanic/ Foreman	1	800/-	9,600.00
Asstt. Foreman	1	600/-	7,200.00
		Rs.	2,42,400.00
(b) Subsidy for operations:		Rs.	6,00,000.00

II. ADDITIONAL STAFF REQD. FOR EXTENSION WORK:

Entomologist	1	2,500/-	30,000.00
For seed distribution & Plant protection	4	600/-	28,800.00
For fertilizers	4	600/-	28,800.00
TOTAL :			87,600.00

N.B. These employees will have to ensure that supplies taken by the growers are in fact used in their presence or whithin their knowledge according to their advice.

Total Cost of Staff	(I + II)		3,30,000.00
Plus incidentals @ 10%			33,000.00
Plus Bonus			37,000.00
		TOTAL:	4,00,000.00

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NOTE (7) COST OF B.M. & R OF 24 MILLS:

The M.I.C. Mission had an employee of Tate & Lyle Ltd. (Engineering Division) as its member. He seems to have come to the conclusion that by the B.M. & R. of 24 of the existing mills at a cost of Rs. 43.0 crores, the crushing capacity of these mills will be increased by about 20,550 tons per day. This will, however, raise the depreciation and interest charges as shown earlier.

Annexure-X

PERFORMANCE OF SUGAR MILLS

(1965- 1968)

	1965-66			1966-67			1967-68		
	Cane crushed (in Mds)	Production (in tons)	Recovery	Cane crushed (in Mds)	Production (in tons)	Recovery	Cane crushed (in Mds)	Production (in tons)	Recovery
FRONTIER									
Mardan	1,88,33,200.00	58,643.13	8.48	1,53,78,612.00	28,656.67	5.88	1,07,82,206.00	32,919.70	8.34
Charsada	1,04,57,302.00	28,109.69	7.32	62,76,833.00	13,761.97	5.97	53,05,190.25	15,317.88	7.88
Frontier	63,75,143.37	20,556.76	7.97	49,46,800.00	975.63	5.56	40,22,831.50	12,701.11	8.52
Bannu	43,25,605.00	12,296.86	8.38	52,61,547.76	19,364.44	5.03	31,72,919.63	9,228.69	7.91
	3,98,91,250.37	1,20,306.44		3,18,63,792.76	62,758.61		2,32,83,147.38	70,167.38	
PUNJAB									
Shahtaj	----	---	--	--	---		----	--	--
Noon	----	----	----	64,66,371.92	16,962.93	7.23	44,31,104.12	13,851.92	8.51
Noor	69,82,689.42	22,416.36	8.74	77,40,510.00	22,228.38	7.82	38,47,000.06	12,684.91	8.98
Deish	72,13,228.12	23,128.98	8.70	69,77,022.13	18,746.16	7.31	45,91,501.38	14,219.29	8.43
Hussain	---	---	--	---	---		9,66,473.00	2,901,01	8.28
B'Nagar	--	---	--	----	---		--	---	--
Hyesons	97,72,145.37	28,396.26	7.90	76,11,590.30	23,105.66	8.26	61,00,000.00	20,080.80	8,95
Facto	-	--	--	59,32,159.50	15,842.63	7.28	41,40,803.00	14,232.83	9.35
Crescent	1,10,37,583.00	38,730.50	9.55	1,10,20,785.50	35,578.48	8.30	55,69,040.38	17,530.51	8.58
Rahwali	35,58,140.00	11,088.48	8.49	30,91,830.00	7,900.61	6.96	14,00,000.00	4,545.45	8.21
United	---	---	--	---	--	--	---	---	--
Modern	---	---	---	---	---	---	---	---	---
Shakerganj	---	--	--	--	---	---	--	---	---
	5,85,61,785.91	1,23,720.58		4,88,40,243.35	1,38,364.85		3,10,45,921.94	1,00,046.72	
SIND									
Mirpur	21,76,827.00	7,421.77	9.28	41,17,843.00	13,792.93	9.12	26,15,767.00	8,971.11	9.36
Bawany	49,88,311.00	16,215.35	8.85	59,55,990.00	19,364.44	8.33	39,41,471.45	13,427.47	9.27
Habib	90,81,931.75	27,491.51	8.23	49,10,181.37	13,990.40	8.10	44,49,409.00	14,422.70	8.81
Mehran	---	--	--	--	--	--	---	---	--
Fauji	81,57,974.50	29,079.19	9.69	67,99,643.00	23,139.90	9.26	56,48,660.00	21,052.53	10.14
Fauji Khoski	---	--	--	---	--	-	--	--	-
Alnoor	---	--	--	---	--	-	--	---	-
Larakana	-	-	-	-	--	--	--	--	--
	2,44,04,464.25	80,207.82		2,17,83,657.37	70,287.67		1,66,55,307.45	57,873.81	
GRAND TOTAL	10,28,57,500.53	3,24,234.84		10,24,87,693.48	2,71,411.12		7,09,84,376.77	2,28,087.91	

(Continued)

PERFORMANCE OF SUGAR MILLS
(1965 to 1976)

	1968-69			1969-70			1970-71		
	Cane crushed (in Mds.)	Production (in tons)	Recovery	Cane crushed	Production (in tons)	Recovery	Cane crushed (in Mds.)	Production (in tons)	Recovery
FRONTIER									
Mardan	1,15,18,[illegible].00	38,386.06	8.69	1,74,64,897.00	51,477.47	8.05	1,59,84,876.00	35,352.00	5.02
Charsada	64,84,[illegible].00	30,032.22	8.46	1,04,04,874.00	20,444.95	8.05	77,21,355.00	13,346.85	4.72
Frontier	42,94,369.00	12,965.05	8.22	53,33,286.00	15,417.78	7.29	52,53,226.87	9,281.61	4.72
Banmu	17,69,[illegible].38	[illegible],514.84	8.50	36,21,494.375	11,515.96	8.66	62,43,377.375	12,426.85	5.41
	2,40,38,[illegible].38	74,898.17		3,68,24,551.375	1,07,856.16		3,52,07,836.245	70,408.14	
PUNJAB									
Shahtaj	45,42,337.50	11,363.65	8.61	1,08,66,777.00	31,626.27	7.93	78,74,[illegible].125	23,671.91	8.58
Nilan	73,95,766.65	21,827.67	8.53	1,11,25,000.00	34,451.92	8.42	76,65,965.00	23,006.06	8.85
Noor	56,54,500.00	18,442.02	8.87	1,01,90,901.20	39,169.40	9.30	77,60,[illegible].06	23,540.20	8.25
Leish	74,84,012.50	22,760.81	8.27	80,74,821.75	24,526.76	8.26	[illegible]50,34,[illegible]30.75	14,569.29	7.85
Hussain	(2,99,612.75	20,514.[illegible]	[illegible]	1,14,30,267.75	36,711.62	8.74	81,05,541.375	26,939.39	9.05
B'Nagar	33,23,340.00	10,340.80	8.66	85,08,300.00	26,612.73	8.52	76,93,234.00	24,846.46	8.77
Hyesons	1,01,53,272.00	32,703.33	8.78	1,34,77,433.00	39,407.58	8.09	1,00,88,848.00	31,132.52	8.29
Fecto	84,96,611.25	22,245.75	8.23	1,00,46,016.27	33,783.66	8.15	75,34,083.34	24,117.35	8.71
Crescent	90,62,[illegible].50	31,[illegible].00	8.51	1,51,20,831.275	47,784.34	8.62	95,33,720.375	30,748.17	8.75
Rahwali	17,59,454.25	5,[illegible]14.14	8.36	29,43,417.25	8,496.46	7.98	25,02,[illegible]10.25	------	8.12
United	--	--	--	--	-	-	--	--	-
Modern	--	--	--	--	--	-	--	--	-
Shakerganj	-	-	-	-	-	-	-	-	-
	6,26,11,[illegible]52.40	202,622.11		10,17,83,765.595	3,22,552.74		7,27,12,141.77	2,24,571.35	
SIND									
Mirpur	54,38,581.00	17,759.09	8.80	1,14,94,845.00	32,923.02	7.87	1,34,57,085.00	42,489.88	8.59
Bawany	68,11,[illegible]75.00	23,069.90	9.22	1,00,63,361.00	31,359.70	8.48	1,26,17,741.00	39,026.37	8.42
Habib	84,19,[illegible]9.00	21,[illegible]4.65	7.95	1,16,14,735.00	35,361.02	8.29	1,35,08,898.00	41,727.56	8.49
Ishran	2,01,[illegible]8.00	3,827.[illegible]8	8.75	85,39,505.00	27,843.03	8.87	1,37,44,443.00	42,713.93	8.47
Phaji	85,70,[illegible]6.00	30,188.69	9.60	1,10,01,[illegible]55.00	36,773.34	9.08	1,44,24,665.00	46,110.59	8.62
Faiji Khoski	--	--	-	---	-	-	--	--	-
Ahseer	---	--	-	---	-	-	---	--	-
Larakana	--	---	-	---	-	-	--	--	--
	2,05,01,[illegible]64.00	99,430.31		5,27,13,501.00	1,64,260.00		6,77,52,832.00	212,068.38	
Grand Total	11,61,49,219.78	376,950.59		19,13,21,817.96	5,94,669.01		17,56,72,810.015	507,047.82	

(Continued)

PERFORMANCE OF SUGAR MILLS
(1965 to 1976)

	1971-72			1972-73			1973-74		
	Cane crushed (in Mds.)	Production (in tons)	Recovery	Cane crushed (in Mds.)	Production (in tons)	Recovery	Cane crushed (in Mds.)	Production (in tons)	Recovery
FRONTIER									
Mardan	1,32,54,880.00	39,151.91	8.00	1,13,18,600.00	33,972.63	8.17	1,07,39,533.000	29,447.98	7.46
Charsada	55,99,765.25	16,858.58	8.16	55,67,381.25	17,361.31	8.49	54,73,281.625	12,570.91	6.21
Frontier	43,65,425.63	12,953.08	7.71	45,33,957.00	13,377.98	8.03	36.28,112.750	9,105.05	6.83
Bannu	40,29,871.87	12,008.73	8.11	35,37,195.87	11,014.24	8.50	40,82,178.625	10,640.00	7.08
	2,72,49,942.37	80,972.30		2,49,57,134.12	75,726.16		2,39,23,101.00	61,763.94	
PUNJAB									
Shahtaj	54,87,593.63	16,819.31	8.35	73,49,402.25	23,636.36	8.73	98,27,553.05	28,454.24	7.88
Noon	48,98,100.00	15,500.68	8.71	60,85,436.00	19,920.91	8.93	96,24,305.25	28,483.33	8.05
Noor	39,10,958.45	12,[illegible].09	8.97	49,13,280.82	16,074.55	8.90	75,66,297.60	21,893.54	7.88
Leiah	37,87,587.50	12,[illegible].58	8.90	55,80,322.12	15,570.20	8.35	61,44,525.50	15,154.80	6.70
Hussain	54,99,773.00	16,[illegible].15	9.49	55,05,365.12	18,096.67	8.96	81,00,174.375	23,757.17	8.00
B'Nagar	23,79,291.50	7,[illegible].69	8.07	22,72,330.00	7,477.88	8.92	61,42,059.875	19,116.46	8.46
Hyesons	40,67,325.00	12,[illegible].68	8.50	56,07,189.00	18,739.29	9.13	77,84,715.00	19,261.01	6.76
Fecto	51,62,540.62	17,[illegible].01	9.10	47,43,863.50	15,957.58	9.14	75,17,446.75	20,461.92	7.40
Crescent	65,96,197.26	22,[illegible].30	9.37	70,60,861.37	23,864.59	9.21	91,77,516.625	26,550.81	7,87
Rahwali	--	2,517.67	--	12,57,384.00	3,440.40	7.36	22,40,127.00	6,108.18	7.45
United	5,17,932.00	1,049.00	6.06	39,39,397.75	11,413.79	7.77	87,45,197.00	21,670.71	6.69
Modern	--	--	--	9,24,891.00	2,559.09	7.76	65,75,835.00	18,942.42	8.07
Shakerganj	---								
	4,23,07,398.95	1,41,360.40		5,52,39,722.93	176,751.31		8,92,45,733.025	249,854.59	
SIND									
Mirpur	29,20,956.00	10,042.20	9.35	47,63,645.00	16,920.20	9.67	98,30,553.00	32,021.72	8.86
Bawany	54,80,540.00	17,918.16	8.90	58.09,191.00	20,383.84	9.54	91,75,452,00	31,159.39	9.24
Habib	34,35,[illegible]0.00	9,891.42	9.88	83,01,695.00	28,016.86	9.19	1,00,13,034.00	30,833.23	8.37
Mehran	40,43,635.00	13,370.10	9.00	49,59,781.75	17,101,31	9.38	1,20,29,949.00	39,172.42	8.81
Fauji	65,39,[illegible]35.00	21,945.16	9.15	90,79,693.00	33,034.85	9.94	1,21,50,121.00	41,062,12	9.17
Fauji Koski	52,83,575.00	19,088.26	9.81	82,70,253.75	22,909.09	9,96	1,00,62,792.25	35,307.17	9.55
Almoor	32,73,[illegible]95.00	8,465.56	7.09	62,23,315.00	19,320.70	8.48	76,09,666.00	21,107.66	7.52
Larakana	-	-	-	-	-	-	-	-	-
	3,09,7[illegible],026.00	1,00,640.86		4,54,07,574.50	1,57,686.85		6,11,39,567.25	2,30,663.71	
GRAND TOTAL	10,05,36,467.32	3,22,975.16		12,56,04,431.55	4,10,164.32		17,43,08,401.275	2,282.24	

Continued)

PERFORMANCE OF SUGAR MILLS
(1965 to 1976)

	1974-75			1975-76		
	Cane crushed (in Mds.)	Production (in tons)	Recovery	Cane crushed (in Mds.)	Production (in tons)	Recovery
FORNTIER						
Mardan	1,56,29,070.00	48,768.69	8.51	1,34,47,800	47,833,654	7.32
Charsada	86,71,500.00	26,739.39	8.39	66,23,366	24,088,[illegible]39	7.00
Frontier	49,00,667.37	14,213.84	7.90	39.88,627	14,399,114	6.68
Bannu	70,13,238,125	15,210,10	8.27	48,33,388	14,970,854	8.27
	3,42,21,[illegible]4,495	1,04,932.02		2,88,93,181	1,01,292.481	
PUNJAB						
Shahtaj	90,10,017.250	30,036.46	9.075	98,71,947	30,388,138	8.40
Noon	75,00,812.70	24,685.56	9.21	84,55,714	26,312,420	8.49
Noor	53,77,554.25	18,402.83	8.987	75,24,246	22,668.830	8.20
Laish	46,79,[illegible]09.75	15,178.79	8.85	69,86,379	21,396.030	8.34
Hussain	50,70,[illegible]87.375	16,258.99	8.55	75,44,853	22,147.000	8.01
B'Nagar	44,31,021.75	14,915.50	9.30	72,33,208	22,692.400	8.51
Hysons	43,36,[illegible]55.00	15,048.59	8.24	1,21,42,054	34,779.100	7,80
Fecto	58,[illegible]0,703.375	20,080,91	9.20	78,47,819	24,379,650	8.31
Crescent	54,07,565,75	17,790,04	8.79	78,20,840	23,339,330	8.15
Rahvali	23,10,165,[illegible]7	6,489,48	7.62	25,75,907	7,312.710	7.73
United	34,55,[illegible]37,375	10,041,67	7.66	1,15,96,612	34,748,600	8.21
Modern	62,92,[illegible]63.00	21,085.35	9.01	81,93,919	25,069.080	8.31
Shakerganj	27,8[illegible],[illegible]63.35	8,390.15	8.30	66,01,578	18,526,330	7.54
	6,88,41,[illegible]13,73	2,20,414,32		10,43,95,076	2,12,994.260	
SIND						
Mirpur	36,23,[illegible]33,00	11,810.10	8.35	64,52,580	23,616.73	9.18
Bawany	46,67,[illegible]13.00	15,033.13	8.75	61,78,362	24,148.90	9.09
Habib	31,53,[illegible]39.00	9,842.98	8.50	85,23,192	31,199.50	8.57
Mohrun	37,66,[illegible]15.00	12,032.02	8.67	64,86,448	20,953.10	8.82
Fauji	99,36,220.00	32,348.03	9.58	98,69,270	33,293.63	9.04
Fauji Khoski	78,82,769.75	26,787.68	9.26	79,21,480	28,707.76	9.89
Minoor	40,00,[illegible]91.00	11,553,74	7.90	84,81,855	30,488.97	8.34
Lurakana	-	-	-	34,80,028	10,537.40	8.21
	3,66,84,[illegible]30,375	1,20,799.09		5,73,93,213	2,02,945.99	
GRAND TOTAL:	13,89,87,[illegible]78.60	4,47,145.43		19,06,81,470	6,17,993.149	

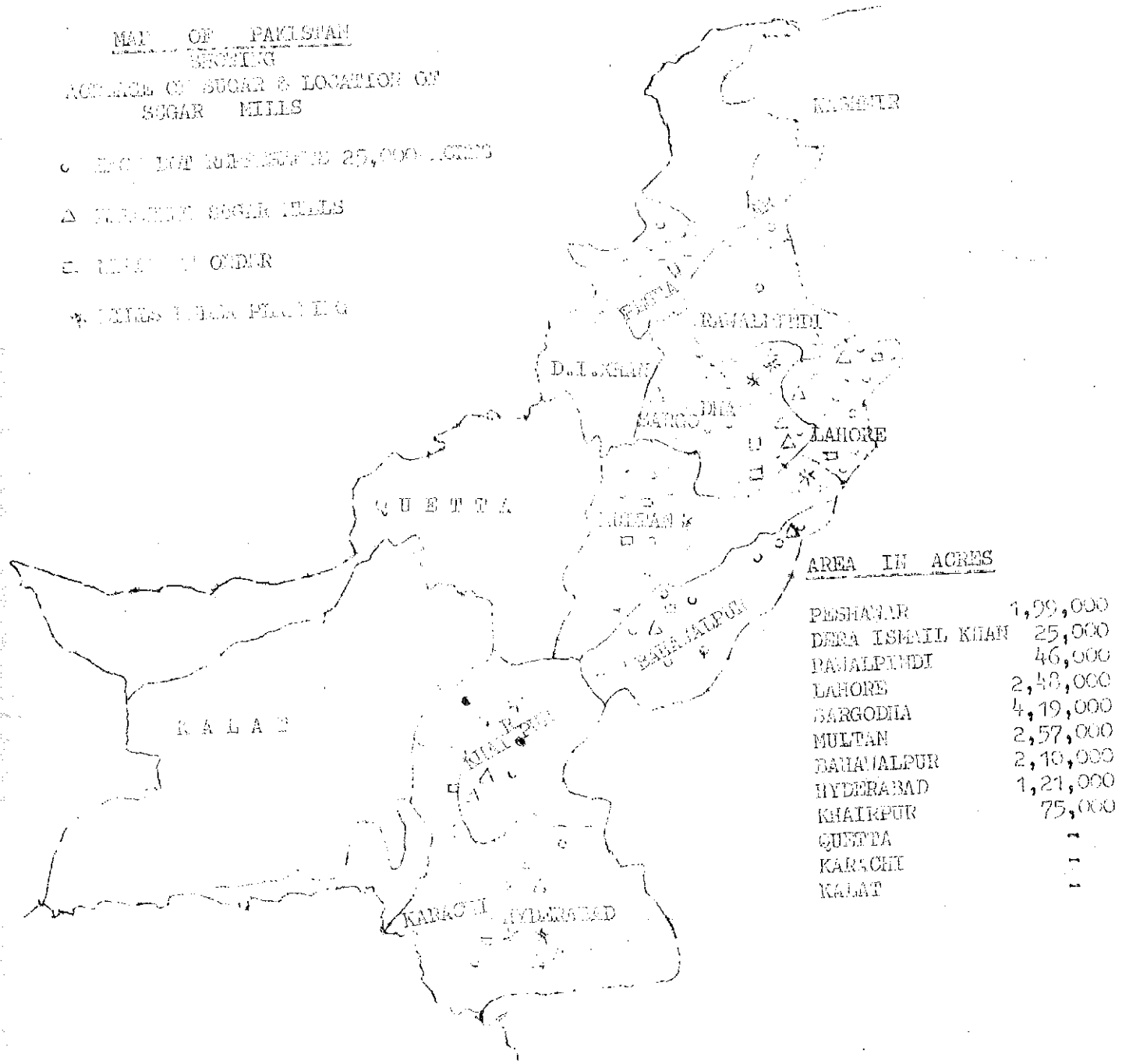
ANNEXURE XI

MARKET RESEARCH & STATISTICS

YEAR-WISE EXPORT OF RAW COTTON, VALUE & PRICE PER BALE, DURING FISCAL YEAR 1951-52 TO 1975-76

Y E A R (July-June)	Quantity (Bales)	Value (000 Rs)	Price per bale (Rs)
1951 - 52	1,117,763	777,489	696
1952 - 53	1,537,427	693,995	451
1953 - 54	1,194,808	497,365	416
1954 - 55	727,619	296,549	408
1955 - 56	967,922	462,137	478
1956 - 57	677,310	352,368	520
1957 - 58	444,681	215,785	485
1958 - 59	470,184	190,355	405
1959 - 60	457,853	188,823	412
1960 - 61	299,000	137,588	460
1961 - 62	278,452	123,450	443
1962 - 63	590,688	369,969	415
1963 - 64	907,237	340,054	375
1964 - 65	739,516	287,043	388
1965 - 66	670,345	278,425	415
1966 - 67	756,368	290,418	384
1867 - 68	1,273,197	441,780	347
1968 - 69	809,213	346,575	428
1969 - 70	471,279	206,393	438
1970 - 71	522,330	257,477	493
1971 - 72	1,417,740	922,167	650
1972 - 73	1,103,449	1,130.179	1,024
1973 - 74	216,606	394,064	1,819
1974 - 75	1,182,937	1,550,361	1,311
1975 - 76	641,952	950,462	1,481

(SOURCE: Central Statistical Office and Cotton Board)



AREA IN ACRES

PESHAWAR	1,99,000
DERA ISMAIL KHAN	25,000
RAWALPINDI	46,000
LAHORE	2,48,000
BARGODHA	4,19,000
MULTAN	2,57,000
BAHAWALPUR	2,10,000
HYDERABAD	1,21,000
KHAIRPUR	75,000
QUETTA	-
KARACHI	-
KALAT	-