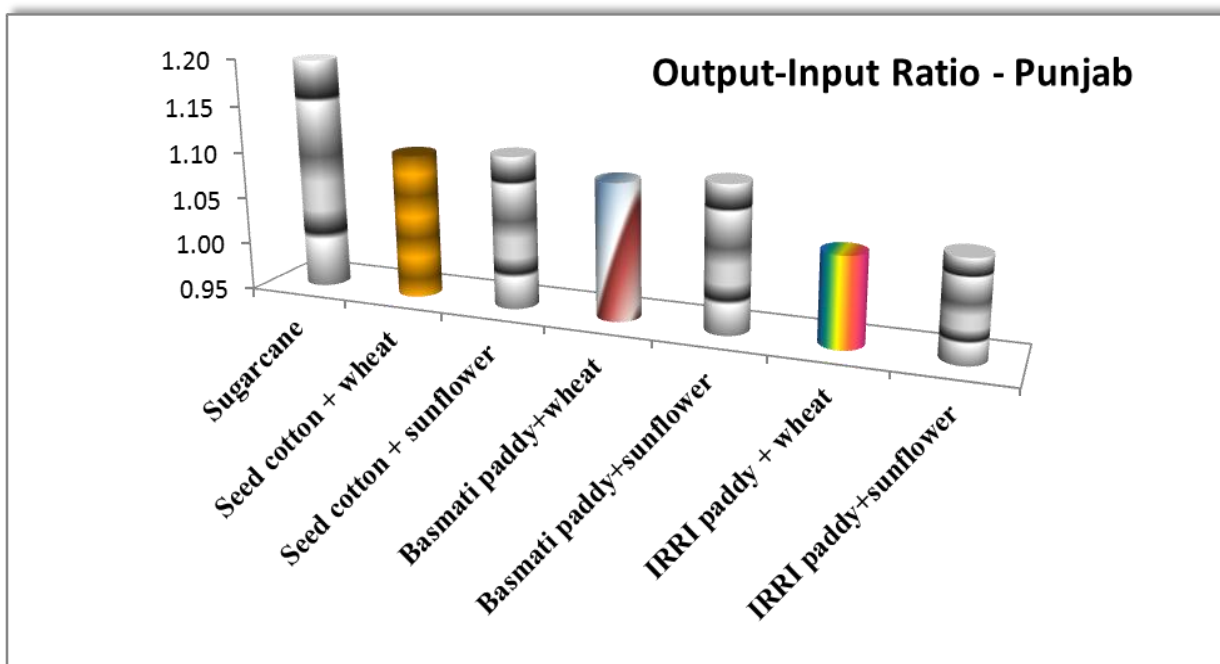


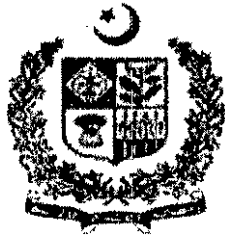


SUGARCANE POLICY ANALYSIS FOR 2020-21 CROP



**AGRICULTURE POLICY INSTITUTE
MINISTRY OF NATIONAL FOOD SECURITY AND RESEARCH
GOVERNMENT OF PAKISTAN
ISLAMABAD**

NOVEMBER 2020



**SUGARCANE POLICY ANALYSIS
FOR
2020-21 CROP**

**Agriculture Policy Institute
Ministry of National Food Security and Research
Government of Pakistan
Islamabad**

November 2020

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Preface

The fundamental objective of this report is to provide information on various economic aspects of the sugarcane crop, crucial in the formulation of the indicative price policy. A report of this kind is important because a broader audience benefits, ranging from policy makers to planners, academia, researchers, student community, growers/growers' associations, chambers of agriculture, traders, etc.

The single title of the report may not lengthily reflect the scope and purpose, unless the reader travels through the important elements of the report. Many portions are relevant, however, a few economic factors have been described as the building blocks which provide useful insights into the indicative price policy perspective. It is partly uncontrollable curiosity of the stakeholders and partly the practical needs of policy makers that this report be there to give answers to the questions on determining of producer price of the commodity.

We as API team, collectively owe thanks to all the Committee members and participants of the various meetings, for their valuable discussion and input, Federal and Provincial Government departments for sharing of information, without all that it would have not been possible to complete the report.

API greatly appreciates the feedback and suggestions from all four corners, looking forward for a continued partnership in the formulation of price policy analyses and the publication of reports.

(Abdul Karim)
Director General

Dear Mr. [Name],
I have received your letter of the 15th and am glad to hear from you.
I am sorry that I cannot give you a more definite answer at this time.

I am sure that you will understand my position.
I will be glad to discuss this matter further with you if you wish.
I am sure that we can reach a satisfactory arrangement.
I am sure that you will be satisfied with the result.

I am sure that you will be satisfied with the result.
I am sure that you will be satisfied with the result.

I am sure that you will be satisfied with the result.
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I am sure that you will be satisfied with the result.
I am sure that you will be satisfied with the result.

I am sure that you will be satisfied with the result.
I am sure that you will be satisfied with the result.

Sincerely,
[Name]

CONTENTS

Description	Page No.
Summary for the Provinces – Price Policy Option for 2020-21 Crop	i-ii
Summary of Findings and Recommendations	iii-vi
1. Introduction	1
2. Sugarcane Planting Harvesting and Seasons	3
3. Provincial Shares in Area and Production of Sugarcane	3
3.1 Area and Production	3
4. Important Sugarcane Producing Districts	6
5. Change in Area Yield and Production of Sugarcane	6
5.1 Long Term Changes 2009-10 to 2019-2020	6
5.2 Short Term Changes 2018-19 to 2019-2020 Crops	7
6. Targets vs Achievements: 2019-20 Crop	8
7. Cost of Production Sugarcane	9
7.1 Cost of Major Operations	11
8. Nominal and Real Indicative / Market Prices of Sugarcane	13
8.1 Nominal and Real Indicative Prices of Sugarcane in Punjab	13
8.2 Nominal and Real Market Prices of Sugarcane in Sindh	14
9. Comparative Economics of Sugarcane and Competing Crops	15
9.1 Economics of Sugarcane: Inter Provincial Comparison	17
10. Impact of increases in Sugar Price on Consumer Price Index (CPI)	18
10.1 Impact of CPI	18
10.2 Impact of Household Expenditure	19
11. Economic Efficiency of Sugarcane Production	20
11.1 Nominal Protection Coefficient (NPC)	20
11.2 Effective Protection Coefficient (EPC)	22
11.3 Domestic Resources Cost Coefficient (DRC)	23
12. Domestic Demand, Supply, Stock and Prices of Sugar	24
12.1 Domestic Demand, Supply and Stocks	24
12.2 Behaviour of Sugar Prices in Domestic Market	25
13. World Supply, Demand, Stocks, Trade and Prices of Sugar	25
13.1 Supply Demand, Stocks and Trade	25
13.2 International Prices of Sugar	26
14. Import and Export Parity Prices of Sugarcane	27
15. Mill-gate Prices of Sugarcane Based on Domestic Wholesale Prices of Sugar during 2018-19 Consumption Year	27
16. Use of Sugarcane Cess Fund	28
17. Sugarcane Crop Research and Development in Pakistan	29
18. Marketing of Sugarcane	30
18.1 Delayed Payments	30
18.2 Underweighting and Undue Deductions	30
18.3 Presence of Middlemen	30
18.4 Provision of Seed Approved Varieties	31
18.5 Low Plant Population	31
18.6 Amendments in Sugarcane Factories Control Act, 1950	32
19. Value Addition and Vertical Integration in Sugar Industry	32
20. Improving Productivity	32
20.1 Varietal Development	32
20.2 Sugarcane Seed Certification Process in Punjab	33
20.3 Balanced Use of Fertilizer	33
21. Sugarcane Yield Among Competing Countries	34
22. Measures for Improving Productivity	36
22.1 Varietal Development	36
22.2 Improved Cultural practices	36
22.3 Biological Control	37
22.4 Role of Sugar Industry in Cane Development	37
22.5 Low Sugar Recovery	37
22.6 Commercial Varieties and Their Yield Potential in the Punjab, Sindh and KP	37
23. Acknowledgement	39
24. Annexes	40 – 67

S.No.	Tables	Page No.
1.	Planting and Harvesting Times of Sugarcane by Province	3
2.	Comparisons of Provincial Shares in Area and Production of Sugarcane: 2009-10 2011-12 and 2017-18 to 2019-20	3
3.	Average Annual Growth Rate of Area, Yield and Production of Sugarcane: 2009-10 to 2019-20	7
4.	Area, Yield and Production of Sugarcane: 2018-19 Vs 2019-20 Crops	8
5.	Targets and Estimated Achievements of Area, yield and Production of Sugarcane:2019-20 Crop	9
6.	Average farmers Cost of Production of Sugarcane in Punjab:2019-20 and 2020-21	11
7.	Cost of Major Items of Sugarcane: 2019-20 and 2020-21Crops	12
8.	Nominal and Real Indicative & Market Prices of Sugarcane Realized by the Growers in the Punjab: 2015-16 to 2019-20	14
9.	Nominal and Real Indicative & Market Prices of Sugarcane Realized by the Growers in Sindh: 2015-16 to 2019-20	15
10.	Economics of Sugarcane and Competing Crops at Prices Realized by the Growers: 2019-20 Crops in Punjab Province	16
11.	Economics of Sugarcane and Competing Crops at Prices Realized by the Growers: 2019-20 Crop in Sindh	17
12.	Input Use Level and Yield of Sugarcane in Sindh Vs Punjab:2019-20 Crop	18
13.	Impact of increase in Sugar Prices on CPI and Household Expenditure	19
14.	Nominal Protection Coefficients for sugarcane in Punjab and Sindh	21
15.	Effective Protection Coefficient's for Sugarcane in Punjab and Sindh	22
16.	Domestic Resources Cost Coefficients (DRC) for sugarcane in Punjab and Sindh Provinces	23
17.	Domestic Requirement Situation of sugar During 2019-20	24
18.	World Balance Sheet of Sugar (Raw Equivalent):2018-19 to 2020-21 (Oct-Sep)	25
19.	Import/ Export Parity prices of sugarcane as Worked Back from Average fob (London) Prices of Sugar	27
20.	Sugarcane Prices Estimated from Expected Wholesale Prices of Sugar during 2019-20	28
21.	Varieties Developed by SRI, in last ten Year with their Characteristics	29
22.	Major Sugarcane Producing Countries (Area) of the World: 2017 Crop	34
23.	Major Sugarcane Producing Countries (Production) of the World: 2019 Crop	35

S.No.	ANNEXES	Page No.
I.	PROVINCE-WISE AREA, PRODUCTION AND YIELD OF SUGARCANE IN PAKISTAN: 2008-09 TO 2018-19	40
II.	PROVINCE-WISE AREA, PRODUCTION AND YIELD OF SUGARCANE IN PAKISTAN: 2008-09 TO 2018-19	41
III.	DISTRICT-WISE AREA AND PRODUCTION OF SUGARCANE: AVERAGE OF 2016-17 TO 2018-19	42
IV.	AVERAGE FARMER COST OF PRODUCTION OF SUGARCANE IN PUNJAB: 2018-19 TO 2019-20 CROPS	43
V.	AVERAGE FARMER COST OF PRODUCTION OF SUGARCANE IN SINDH: 2018-19 TO 2019-20 CROP	44
VI.	ECONOMICS OF SUGARCANE AND COMPETING CROPS AT PRICES REALIZED BY THE GROWERS: 2018-19 CROPS	45
VII.	ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE PRODUCTION IN PUNJAB AVERAGE FARMERS: (UNDER SUGAR IMPORTING SCENARIO)	48
VIII.	GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTORS COST IN PUNJAB ESIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES (BASIS – IMPORT PARITY PRICE OF SUGARCANE)	49
IX.	ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN PUNJAB AVERAGE FARMERS: (UNDER SUGAR EXPORTING SCENARIO)	50
X.	GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTORS COST IN PUNJAB ESIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES (BASIS – EXPORT PARITY PRICE)	51
XI.	ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN SINDH AVERAGE FARMERS: (BASED ON IMPORT PARITY PRICES)	52
XII.	GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTORS COST IN SINDH ESIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES (BASIS – IMPORT PARITY PRICE OF SUGAR)	53
XIII.	ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN SINDH AVERAGE FARMERS: (BASED ON EXPORT PARITY PRICES)	54
XIV.	GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTORS COST IN SINDH ESIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES (BASIS – EXPORT PARITY PRICE OF SUGAR)	55
XV.	PER CAPITA AVAILABILITY CONSUMPTION OF SUGR: 2015-16 TO 2017-18 (OCT-SEP)	59
XVI.	DOMESTIC AVERAGE WHOLESALE PRICES OF SUGAR IN MAJOR DOMESIC MARKETS: 2018-19	60
XVII.	AVERAGE WHOLESALE PRICES OF SUGAR IN MAJOR -DOMESIC MARKETS: 2007-08 TO 2018-19 (OCT-SEP)	61
XVIII.	AVERAGE INTERNATIONAL PRICES OF SUGAR: 2008-09 TO 2019-20 (OCTOBER-SEPTEMBER)	62
XIX	IMPORT PARITY PRICES OF SUGARCANE AT MILL-GATE ON THE BASIS OF FOB (LONDON) PRICE OF WHITE SUGAR	63
XX	EXPORT PARITY PRICES OF SUGARCANE AT MILL-GATE ON THE BASIS OF FOB (LONDON) PRICE OF WHITE SUGAR	64
XXI	MILL-GATE PRICES OF SUGRCANE WORKED BACK FROM THE EXPECTED WHOLESALE MARKET PRICES OF SUGAR DURING 2018-19	65
XXII	YIELD PER HECTARE OF MAJOR SUGARCANE PRODUCING COUNTRIES IN THE WORLD:2019 CROP	66
XXIII	COMMERCIAL SUGARCANE VARIETIES DEVELOPED AND RELEASED THROUGH COORDINATED SUGAR CROPS RESEARCH PROGRAM OF THE PARC	67

S.No.	FIGURES	Page No.
I.	SHARES IN AREA	4
II.	SHARES IN PRODUCTION	4
III.	SHARES IN AREA	5
IV.	SHARES IN PRODUCTION	5
V.	OUTPUT - INPUT RATIO OF SUGARCANE IN PPUNJAB	16
VI.	OUTPUT - INPUT RATIO OF SUGARCANE IN SINDH	17
VII.	INTERNATIONAL PRICES OF SUGAR	26

ABBREVIATIONS

AARI	:	Ayub Agricultural Research Institute
API	:	Agriculture Policy Institute
BCR	:	Benefit Cost Ratio
C&R	:	Cost and Freight
CIF	:	Cost, Insurance and Freight
COP	:	Cost of Production
CPI	:	Consumer Price Index
DRC	:	Domestic Resource Cost
ECC	:	Economic Coordination Committee
E&M	:	Economics & Marketing
EPC	:	Effective Protection Coefficient
FAO	:	Food and Agriculture Organization
FOB	:	Free on Board
FSC&RD	:	Federal Seed Certification and Registration Department
FYM	:	Farm Yard Manure
GDP	:	Gross Domestic Product
NARC	:	National Agricultural Research Centre
NFS&R	:	National Food Security and Research
NPC	:	Nominal Protection Coefficient
NSC	:	National Seed Council
OLS	:	Ordinary Least Squares
PARC	:	Pakistan Agricultural Research Council
PBS	:	Pakistan Bureau of Statistics
TCP	:	Trading Corporation of Pakistan
WTO	:	World Trade Organization



SUMMARY FOR THE PROVINCES – SUGARCANE PRICE POLICY OPTIONS FOR 2020-21 CROP

The Agriculture Policy Institute (API) is providing technical input based on a number of economic factor including cost of production estimating to work out the indicative price of sugarcane every year for implementation by the Provincial Governments of Punjab, Sindh and Khyber Pukhtunkhawa. The provinces hold meetings of their respective Sugarcane Control Board to discuss and approve the indicative price of sugarcane with provincial stakeholders. The Provincial Sugarcane Commissioners are responsible to implement the announced price of sugarcane in their respective provinces.

- Likely Price Policy Options

2. The API has carried out economic analysis for determining Indicative Price for Sugarcane 2020-21 Crop. Results of the analysis are summarized as below:-

Indicative Price Policy Options Based on	Sugarcane Price at Mill-gate (Rs per 40 kgs)	
	Punjab	Sindh
1. Cost of production of sugarcane	193.91	194.40
2. Indicative price for 2020-21 crop assuming average wholesale prices of sugar:		
a) Rs 65,000 per tonne	177.92	186.72
b) Rs 70,000 per tonne	191.60	201.08
c) Rs 75,000 per tonne	205.29	215.44
d) Rs 80,000 per tonne	218.97	229.81
e) Rs 85,000 per tonne	232.66	244.17
3. Average price received by cane growers for 2019-20 Crop	220	220
4. Import Parity based on average fob London price of white sugar at US \$ 368.07/ton (Jun 2020).	221.77	232.74
5. Export Parity based on: average fob London price of white sugar at US \$ 368.07/ton (Jun 2020).	130.18	136.62

- **Price Recommendations**

3. During 2019-20, growers of sugarcane got higher prices than indicative price announced by the Provincial Governments. The main reason of this price hike is short supply of cane to sugar mills. It is evident from the statistics that area and production targets fixed by the Federal Committee on Agriculture could not been met. This situation may attract the sugarcane farmers to increase the area of sugarcane and the considerable losses in cotton crop due to climate change factor.
4. The country has produced 4.875 million tonnes of sugar. After accounting for the opening stocks of previous years i.e 2.060 million tonnes and accounted for the import/export quantities, the total sugar supply for 2019-20 consumption year is estimated to 6.760 million tonnes. Based on average per capita availability of sugar estimated at 24.87 kgs on the basis of balance sheet method, 16.36 per annum as reported by the Household Integrated Survey 2018-19 (HIES) by PBS and 22.60 kgs per annum of world level average consumption of sugar during 2019-20, the total domestic requirement for a population of 222.23 million has been worked at 5.527, 3.413 and 5.022 million tonnes, respectively.
5. The monthly average wholesale prices of sugar prevailing in major domestic markets of Lahore, Faisalabad, Karachi, Hyderabad and Peshawar during 2019 (Jun - Dec) and during 2020 (Jan - Jun) is showing upward trend. Average monthly wholesale prices ranged between Rs 7111 per 100 kgs in Faisalabad market during the month of January, 2020 to Rs 7920 per 40 kgs in Karachi markets during the month of May, 2020. The overall average of sugar price at country level ranged between Rs 5350 to Rs 7792 per 100 kgs during 2019-20.
6. Keeping in view the prevailing scenario and the analysis of different economic parameters such as cost of production, export parity prices of sugar, prices of sugarcane realized by the growers during 2019-20, domestic and international market prices of sugar are suggestive of increasing prices of sugarcane in the country.

SUGARCANE POLICY ANALYSIS 2020-21 CROP

EXECUTIVE SUMMARY AND RECOMENDATIONS

INTRODUCTION

Sugarcane is a well-known commercial crop which contains high concentration of sucrose and grown for its sucrose contents which mostly used as refined sugar. It is cultivated in the tropical and subtropical regions of the World. The sugar mills produced several products from sugarcane like refined sugar, raw sugar, molasses, alcohol, rum, bagasse, syrups, dextran, confectionary, crude wax and glucose

In Pakistan sugarcane is cultivated mainly in the districts of Jhang, Faisalabad, Sargodha, Kasur, and T.T Singh of Punjab; Hyderabad, Badin and Thatta of Sindh; and Charsadda and Mardan of KP Climatic conditions of lower Sindh are more favorable having hot and semi-humid climate.

The second largest agro-based sugar industry plays a vital role in the national economy of Pakistan. Located in the country side provides employment opportunities for rural labours, skilled and semi skilled. It generates revenue for government through taxes and levies. The industry also provides raw material to allied industries like, molasses to distilleries for ethanol, organic fertilizer cheap board industry etc. Besides these products, sugar mills also provide electricity to WAPDA during winter.

In view of the importance of the sugarcane and sugar for the economy, the indicative price of sugarcane is annually reviewed by the Government. Technical input, non-binding, is share with provinces for fixation and implementation of the price.

The significance of sugarcane crop and sugar industry in the economy demand from the Government and sugar mills to work together and resolve the problems in production and marketing. To meet the emerging issues in sugar sector, the mills can promote production of sugarcane through research and development efforts and technical guidance to the farmers and the farmers at the same time must appreciate that a healthy industry is in their own interest while a sick industry cannot play effective role in the crop development.

- PER CAPITA AVAILABILITY OF SUGAR

The sugar production from 2019-20 crop has been estimated at 4.875 million tonnes. Based on average per capita availability of sugar estimated from balance sheet method, HIES data and world average consumption, total domestic requirement for a population of 222.23 million has been worked at 5.527, 3.143 and 5.022 million tonnes, respectively for 2019-20.

- ECONOMICS OF SUGARCANE AND COMPETING CROPS

Resource allocation among the competing enterprises is primarily governed by the economic considerations reflected in their gross cost, gross income, gross margin, net income, output-input ratio, etc. Sugarcane is planted in the irrigated regions of the country and being an annual crop, it competes for land, water and other farm resources with both 'kharif' and 'rabi' crops.

In Punjab, growers' returns to overall investment, based on the prices received by growers against the indicative price announced by the provincial government, remained higher for sugarcane, against the cotton combinations for the entire criteria except purchased inputs. Sugarcane out-competed both Basmati and IRRI combinations in terms of irrigation water in terms of returns to overall investment and Irrigation Water with a big difference.

Sugarcane growers, in Sindh too, have been largely reported receiving the prices better than the indicative price announced for the year 2019-20. The analysis presents a favourable situation for Sugarcane performing better than the competing crops, especially in terms of output-input ratio and returns to purchased inputs. However, wheat and cotton remained better than sugarcane in giving returns to grower in term of crop duration and irrigation water.

- MARKETING OF SUGARCANE

Sugarcane is one of the main cash crops sown on vast areas throughout the country and plays a pivotal role in the national economy. But both in production and processing sugarcane is portraying a number of distortions and inefficiencies. Resultantly, the production of sugarcane and sugar not sustained.

- DELAYED PAYMENTS

In the beginning of the season, the payments are generally made within two weeks but as the season progresses to the end, the payments are delayed by months and in some cases by seasons. During 2019-20 crop, the production of sugarcane was lower than the last year and demand was higher, therefore, the sugar mills made payments timely even than number of

farmers have supplied cane through middlemen for prompt payment and also due to fear that the payment could be delayed at the end of season.

- **UNDERWEIGHMENT**

Underweighment is used to be a complaint of farmers that there was underweighment of cane at the purchase centers and mills gates. The sugar mills are making deductions on the plea that poor quality cane with high trash contents is being supplied by the farmers. However during the current season due to above mentioned reason, these complaints were not reported widely by the farmers.

- **PRESENCE OF MIDDLEMEN**

Due to mistrust between farmers and sugar mills and all above mentioned reason, the role of middleman becomes stronger and increasing day by day in sugarcane business.

- **USE OF SUGARCANE CESS FUND**

On the repeated suggestion of Agriculture Prices Commission presently Agriculture Policy Institute in the Sugarcane Policy Reports that the sugarcane cess fund which was utilized for the construction and improvement of roads in the sugar mills areas may be used for sugarcane research also. The Government of Punjab has allocated 10 per cent of cess fund for research and development of sugarcane.

- **IMPROVING PRODUCTIVITY**

The raw material requirement of sugar industry comprising 89 sugar mills, with crushing capacity of about 350 thousand tonnes per day, has been met through expanding acreage under sugarcane crop

- **VARIETAL DEVELOPMENT**

Development of new varieties of sugarcane is a lengthy process requiring primarily the sugarcane fuzzi either through its local production or imports from abroad.

- **Sugarcane Seed Certification Process in Punjab**

The Government of Punjab has started a process of newly approved sugarcane seed certification process (Seed Standards, tagging process) of FSC & RD by involving government intuitions, PSC, Sugar Mills, private seed companies etc, The implementation of the concept of

certified seed (healthy, pure, true to type and site specific) sugarcane seed production, multiplication and distributions) has been assigned to the Sugarcane Research Institute (SRI), Faisalabad.

- BALANCED USE OF FERTILIZERS

Chemical fertilizers play an important role in enhancing crop productivity but real key for getting maximum returns from the investment on fertilizers is their balanced and timely application.

SUGARCANE POLICY ANALYSIS FOR 2020-21 CROP

INTRODUCTION

Sugarcane is an established agricultural field crop with a long history of safe use. It is a tall-growing monocotyledonous crop that is cultivated in the tropical and subtropical regions of the world, primarily for its ability to store high concentrations of sucrose, or sugar. Sugarcane is grown for its sucrose content and mostly consumed as refined sugar or other processed products. Raw sugarcane can be squeezed or chewed to extract the juice. Sugarcane is grown as a commercial crop primarily in South America, North/Central America, Asia, Africa Australia and the Pacific Islands. Cultivation practices and production vary throughout the world.

2. Several other products are produced from crushing sugarcane at the sugar mill. These include refined sugar, raw sugar, molasses, alcohol, rum, bagasse, syrups, dextran, confectionary, crude wax and glucose.
3. The climate of Pakistan is mainly subtropical arid to semiarid. In Pakistan, sugarcane is cultivated mainly in the districts of Jhang, Faisalabad, Sargodha, Kasur, and T.T Singh of Punjab; Hyderabad, Badin and Thatta of Sindh; and Charsadda and Mardan of K.P. Climatic conditions of lower Sindh are more favourable having hot and semi-humid climate. Per hectare production of sugarcane is much lower as compared to cane growing countries of sugar world. The main reasons for low productivity are: inappropriate plant population due to traditional sowing operation, unbalanced use of fertilizer, inadequate irrigation water supply and lack of plant protection practices, etc.
4. Mostly, sugarcane is utilized for sugar production and annually around 67 to 82 percent sugarcane crushed by the sugar industry but considerable quantities are also used in gur making in the Punjab and Khyber Pukhtunekhawa. Sugar is also produced from sugar beet grown in the K.P. During 2019-20, 4.875 million tonnes of sugar was produced by the country, out of that 0.061 million tonnes produced from sugar beet.
5. Sugarcane is a high value cash crop claiming significance for sugar and sugar related industries in Pakistan. It contributes about 0.6 percent to GDP and 2.9 percent addition in agriculture. During 2019-20, sugarcane production decreased by 0.4 to 66.880 million tones as compared to 67.174 million tons of last year. This decline in sugarcane production is due to decrease of area by 5.4 percent from 1,043 thousand of last year to 1,102 thousand hectares, mainly due to shortage of canal water. Low economic returns in the past and disposal problem of cane and payment difficulties also restricted the acreage of sugarcane.
6. The sugar industry is second largest agro-based industry of Pakistan, located in the country side provides not only employment opportunities for rural labours also generates

employment for management experts, technologists, engineers, financial experts. The industry plays a vital role in the national economy through general sales tax and other indirect taxes levies to the Govt. Besides sugar, the industry provides raw material to allied industries like, molasses to distilleries for ethanol, organic fertilizer. The bagasse has been accepted as a viable alternative raw material to wood in the paper and pulp industry. The sugar mills also provide electricity to WAPDA during winter by using the waste material of sugarcane. It is also a major source of livestock fodder during winter.

7. In view of the importance of the sugarcane and sugar for the economy, the indicative price of sugarcane is annually reviewed by the Agriculture Policy Institute (API), Ministry of National Food Security and Research and shown with provinces for fixation and implementation of price. For the formulation of policy proposals for 2020-21 sugarcane crop, the following steps were taken by the API.

- i) To update the cost of inputs and cultural operations, a field survey was conducted in the important sugarcane regions of Punjab and Sindh. During the course of survey detailed discussions were also held with the growers, crop experts and mill management on issues relating to production and marketing of sugarcane.
- ii) Annual meeting of API Committee on sugarcane was held. The meeting attended by researchers, progressive growers, representative of farmers associations, sugar industry and senior officers of provincial agriculture extension departments. The participants discussed at length issues concerning with cultivation and marketing of sugarcane, current crises of sugar industry and future prospectus. The views expressed in the meeting have been dully considered in formulating proposal contained in this report.
- iii) The data on area, yield, production and prices of sugarcane; domestic as well as world production, demand, stocks, prices and trade of sugar were collected from various relevant sources and analyzed.

8. It is in the interest of industry as well as the growers to stabilize sugarcane production in line with not only to meet the domestic requirement simultaneously, to have a comparative advantage in sugar export. The government in collaboration with sugar mills will have to work together and resolve the problems like price escalation, mal-practices in its marketing, value addition and disposal of sugar, especially no variety should go to the field level unless and until it is fully tested at the research level and sugar mills should work hard to multiply and disseminate high sucrose variety to their contract growers in the surrounding areas.

2. SUGARCANE PLANTING AND HARVESTING SEASONS

9. Sugarcane is a tropical crop which requires temperature more than 20°C for proper germination and growth and two months of dry and cool weather towards maturity. The climatic conditions in Pakistan generally provide a growing season of 8 to 10 months for sugarcane in a year. The recommended times of planting the spring and autumn crops of sugarcane, by province are given in Table-1.

Table-1: Planting and Harvesting Times of Sugarcane by Province

Province	Planting Time	
	Spring Crop	Autumn Crop
Punjab	15 th February to 3 rd week of March	September
Sindh	1 st February to 15 th March	September to 15 th October
K.P	15 th February to 3 rd week of March	September
Harvesting Time		
Punjab, Sindh, KP	15 th October to 1 st March	

Source: +Sugarcane Coordinator, NARC, Islamabad.

3. PROVINCIAL SHARES IN AREA AND PRODUCTION OF SUGARCANE

10. Provincial shares in area and production of sugarcane have been discussed below:

3.1 Area and Production

11. Shares of area and production of sugarcane during the periods 2009-10 to 2011-12 and 2017-18 to 2019-20 and changes therein are presented in Table-2 below:

Table-2: Comparison of Provincial Shares in Area and Production of Sugarcane: 2009-10 to 2011-12 and 2017-18 to 2019-20

Country/Province	Area			Production		
	Average 2009-10 to 2011-12	Average 2017-18 to 2019-20	Change	Average 2009-10 to 2011-12	Average 2017-18 to 2019-20	Change
----- Percent -----						
Pakistan	100.00	100.00	-	100.00	100.00	-
Punjab	68.30	63.42	-7.2	68.49	65.89	-3.8
Sindh	21.76	25.76	18.4	23.34	25.43	8.9
KPK	9.88	10.75	8.9	8.11	8.63	6.4
Balochistan	0.067	0.075	12.2	0.06	0.06	1.9

Source: Worked out from Annex-I.

12. Punjab, Sindh and KP share 63, 26 and 11 percent, respectively in area and 66, 25 and 9 percent in production. Over the time, the share of Punjab has gone down by 7.2 percent in area and 3.8 percent in production. In case of Sindh, share in area is up by 18.4 percent and that of production by 8.9 percent. In the KP, share in area also up by 8.9 percent and 6.4 percent in production. Provincial shares are also depicted in Figures 1 to 4.

FIG-1: SHARES IN AREA

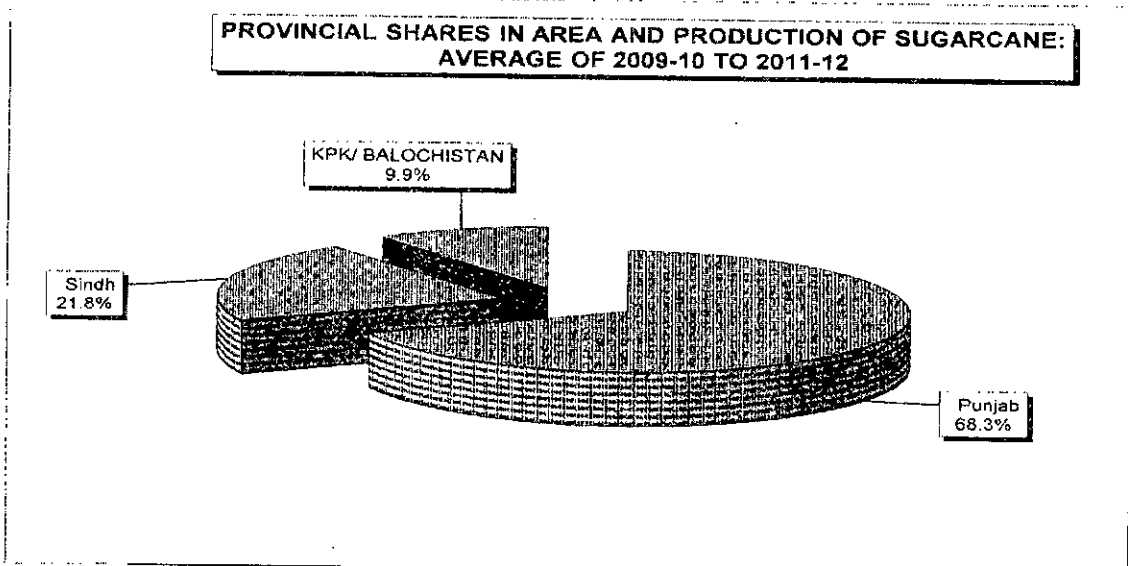
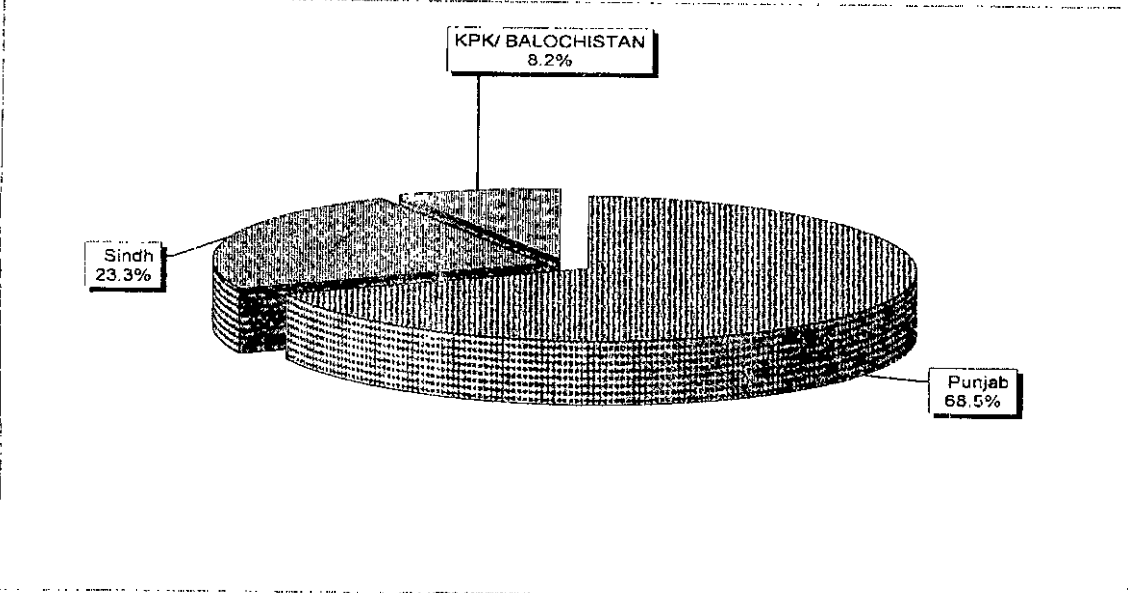


FIG-2: SHARES IN PRODUCTION



SOURCE: TABLE-2

FIG-3: SHARES IN AREA

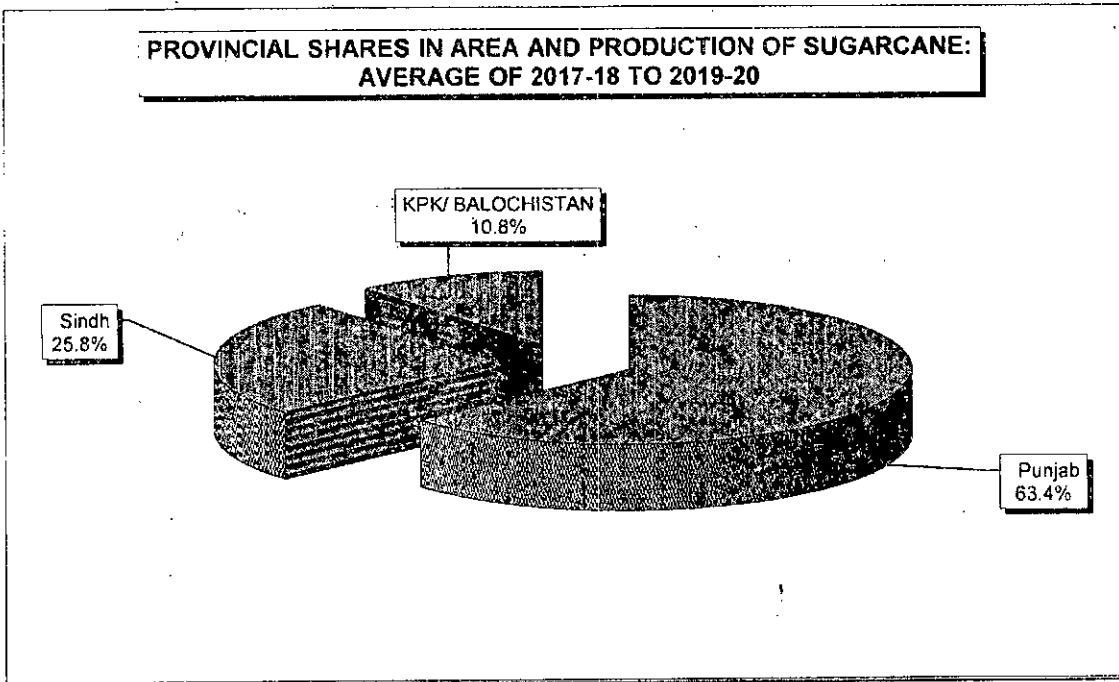
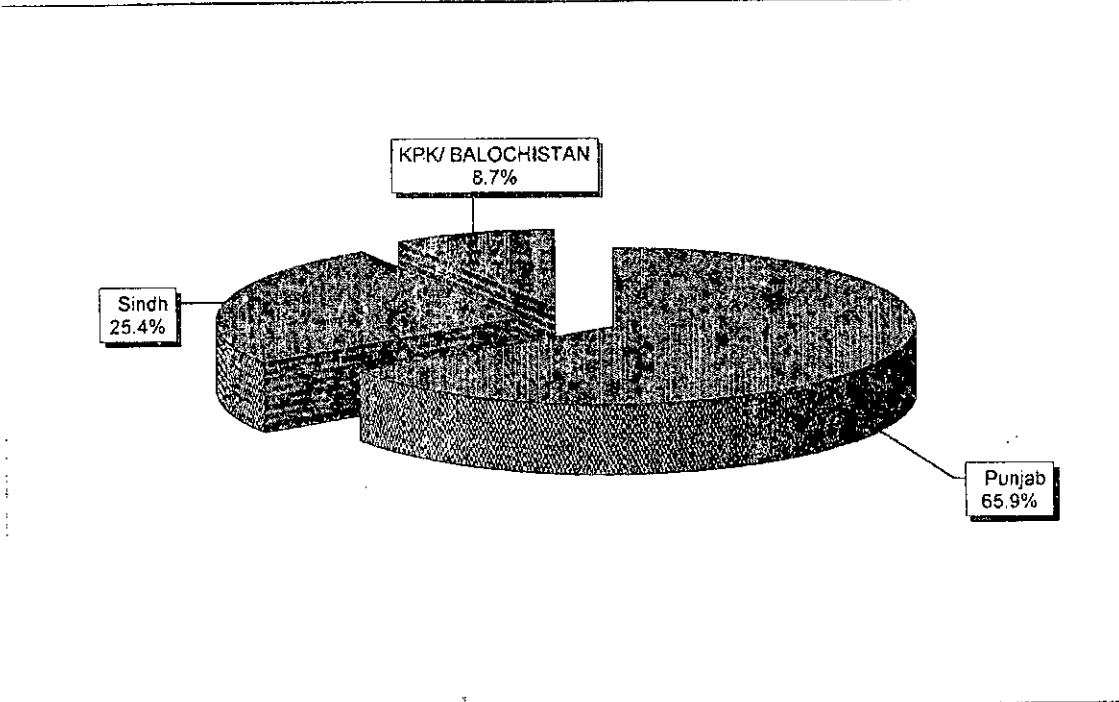


FIG-4: SHARES IN PRODUCTION



SOURCE: TABLE-2

4. IMPORTANT SUGARCANE PRODUCING DISTRICTS

13. Sugarcane is a high delta crop. It is grown in irrigated conditions. Districts which grow 100 thousand tonnes or more of sugarcane are R.Y.Khan, Faisalabad, Sargodha, Muzaffargarh, Jhang, Rajanpur, Chiniot, T.T Singh, Bhakkar, Bahawalpur, Kasur, M.B Din, Layyah, D.G.Khan, Vehari, Bahawalnagar, Nankana Sahib, Okara, Khushab, Khanewal, Hafizabad, Multan, Lodhran, Sahiwal, Mianwali, Sheikhpura, and Gujrat in Punjab and Ghotki Nawabshah, Thatta, N.Feroze, Khairpur, Badin, Tando Allahyar, Tando Muhammad Khan, Sanghar, Matiari, Mirpur Khas, Sukkur, Hyderabad and Dadu, in Sindh while D.I Khan, Charsadda, Mardan, Peshawar, Malakand and Nowshera, from KP. These 48 districts; 26 from the Punjab, 14 from Sindh and 6 from KP collectively account for 99 per cent of the sugarcane area and production (Annex-III).

14. However, 23 districts, namely, R.Y.Khan, Faisalabad, Sargodha, Muzaffargarh, Jhang, Rajanpur, Chiniot, T.T Singh, Bhakkar, Bahawalpur, Kasur, M.B Din, Layyah, Ghotki Nawabshah, Thatta, N.Feroze, Khairpur, Badin, Tando Allahyar, D.I Khan, Charsadda and Mardan collectively produce 84 per cent of the total sugarcane produced in the country.

5. CHANGES IN AREA, YIELD AND PRODUCTION

15. Throughout the decade ending 2019-20, the area under sugarcane at country level ranged between 942.8 to 1341.8 thousand hectares (2329.8 and 3315.6 thousand acres) and production from 49.373 to 83.333 million tonnes. Yield of sugarcane fluctuated between 21.19 to 25.93 tons per acre (Annex-II).

16. Long-term and short-term changes in area, yield and production of sugarcane are discussed below:

5.1 Long-term Changes (Growth rates): 2009-10 to 2019-20

17. During the above mentioned period sugarcane production in Pakistan increased @ 3.4 per cent per annum mainly due to improvement in yield @ 1.7 per cent and area expansion @ 1.6 per cent (Table-3).

Table-3: Average Annual Growth Rate of Area, Yield and Production of Sugarcane: 2009-10 to 2019-20

Country/Province	Area	Yield	Production
	Percent per annum		
Pakistan	1.6	1.7	3.4
Punjab	0.8	2.3	3.1
Sindh	3.8	0.5	4.3
KP	2.6	1.3	3.9
Balochistan	3.1	0.2	3.3

Source:

Worked out from Annex-I.

Note:

The growth rates have been worked out by estimating the equation, $Y = (1+r)^x$, (OLS) from the data given in Annex-I.

18. Sugarcane production in Punjab during the period under reference has increased @ 3.1 per cent per annum as a result of 2.3 per cent improvement in yield and 0.8 per cent expansion in area. Sugarcane production in Sindh has also increased rate of increase by 4.3 per cent due to 3.8 per cent increase in area and 0.5 per cent improvement in yield.

19. In KP sugarcane production also increased @ 3.9 per cent per annum. This is mainly attributed to 2.6 per cent increase in area and 1.3% improvement in yield.

20. Balochistan Sugarcane production also increased @ 3.3 per cent per annum due mainly to 3.1 per cent expansion in area and 0.2 per cent improvement in yield.

5.2 Short-term Changes: 2018-19 and 2019-20 Crops

21. According to final estimates of Provincial Agriculture Departments (Crop Reporting Service) sugarcane production at country level for 2019-20 crop is reported at 67.020 million tonnes reflecting slightly a decrease of 0.2 per cent over last year production of 67.174 million tonnes. Decrease in production is mainly due to 5.1 per cent decline in area while the yield evidenced 5.1 per cent improvement (Table-4).

Table-4: Area, Yield and Production of Sugarcane: 2018-19 versus 2019-20 Crops

Country/ Province	Area		Changes	Yield		Change s	Production		Changes
	2018-19	2019-20		2018-19	2019-20		2018-19	2019-20	
	000 ha		Per cent	tonnes per ha		Per cent	000 tonnes		Per cent
Pakistan	1102.0	1046.1	-5.1	61.0	64.1	5.1	67173.9	67020.3	-0.2
Punjab	710.6	643.4	-9.5	63.2	67.4	6.6	44906.3	43346.6	-3.5
Sindh	279.5	286.1	2.4	59.7	62.9	5.4	16691.3	18004.7	7.9
KP	111.0	115.7	4.2	49.8	48.6	-2.5	5532.0	5623.8	1.7
Balochistan	0.87	0.89	2.3	50.9	50.8	-0.3	44.3	45.2	2.0

Source: Annex-I.

22. Sugarcane production for 2019-20 in Punjab is reported at 43.347 million tonnes which shows a decrease of 3.5 per cent over the last year. The decrease mainly ensued due to 9.5 per cent decrease in area though 6.6 per cent improvement observed in yield, the highest amongst the provinces.

23. Sindh sugarcane production for 2019-20 crop, increased by 7.9 per cent over the previous year. This escalation is attributed mainly to 2.4 and 5.4 per cent rise in area and yield respectively.

24. In KP, production increased by 1.7 per cent due to 4.2 per cent growth in area but the yield declined 2.5 per cent in yield.

25. Balochistan production also increased by 2.0 per cent due to 2.3 per cent increase in area, while 0.3 per cent decreased evidenced in yield.

6. TARGETS VS ACHIEVEMENTS: 2019-20 CROP

26. The Federal Committee on Agriculture (FCA) fixed sugarcane production target for 2019-20 crop at 68.702 million tonnes. As per final estimates of the Provincial Agriculture Departments sugarcane production from 2019-20 crop is reported at 67.020 million tonnes (2.4 per cent less than the target). This is net effect of 9.9 per cent over achievement in yield and 11.2 per cent decreased in area (Table-5).

Table-5: Targets and Estimated Achievements of Area, Yield and Production of Sugarcane: 2019-20 Crop

Country/ Province	Area		Deviation from the target	Yield		Deviation from the target	Production		Deviation from the target
	Target	Achieve- ment		Target	Achieve- ment		Target	Achieve- ment	
	--- 000 hec ---		Per cent	Tonnes/hec		Per cent	-- 000 tonnes --		Per cent
Pakistan	1178.5	1046.1	-11.2	58.3	64.1	9.9	68701.7	67020.3	-2.4
Punjab	753.0	643.4	-14.6	59.6	67.4	13.0	44906.3	43346.6	-3.5
Sindh	310.0	286.1	-7.7	59.2	62.9	6.4	18338.6	18004.7	-1.8
KP	114.6	115.7	1.0	47.2	48.6	2.9	5411.3	5623.8	3.9
Balochistan	0.9	0.9	-1.1	50.6	50.8	0.5	45.5	45.2	-0.7

Sources:

1. For targets: Targets have been fixed by FCA, NFS&R, Islamabad
2. For achievements: Annex-I.

27. In Punjab province, sugarcane area and production lagged the targets by 14.6 per cent and 3.5 per cent. While Sindh province also fell short of these targets by 7.7 per cent and 1.8 per cent. KP exceeded targets in area and production by 1.0 per cent and 3.9 per cent. Balochistan failed in area and production of sugarcane by 1.1 per cent and 0.7 per cent against the targets specified by FCA.

7. COST OF PRODUCTION OF SUGARCANE

28. Cost of production is an important factor in formulating price proposals for farm produces. Its empirical estimation, however, entails several conceptual problems and practical difficulties because of wide variations in agro-climatic conditions and farm systems under which the crop is raised. In case of sugarcane, the problem is further compounded as fresh and ratoon crops with different duration and husbandry practices are grown. Moreover, the fresh crop is sown at two different periods, i.e. in spring and autumn, resulting in varying crop duration, use of inputs and yield levels.

29. Agriculture Policy Institute, at the conclusion of crop year collects field data on different component, of production to assess the cost incurred on growing the crop. These estimates provide guidance in determining indicative price of the concerned crop.

30. Cost of production estimates of sugarcane for 2020-21 crop in Punjab and Sindh are determined using customary input-output parameters defined on the basis of field surveys, consultation mechanism and secondary data.

31. In this section, different inputs like seed, fertilizer, sprays, irrigations (tube well and canal) and tractor run operations made for preparing soil and sowing seed and hoeings are used to forecast cost of production for 2020-21 sugarcane crop. Their physical usage (quantities) are those done during 2018. However, respective prices and hiring rates for the above referred tractor operations are those prevailing in major sugarcane producing zones of Punjab and Sindh.

32. Consolidated summary of cost of production of sugarcane for 2020-21 crop for Punjab and Sindh are produced in Table-6- while background data are placed in Annex-IV and V.

- Punjab

33. The estimated cost of cultivation of sugarcane in Punjab for 2020-21 works out to Rs 122,786 inclusive of land rent with expected yield of 700 kg per acre. The cost of production of sugarcane at farm level with land rent comes to Rs 175.41 per 40 kgs and Rs 121.24 per 40 kgs without land rent. By adding marketing cost @ Rs 18.50/40 kg to these estimated, cost of production per 40 kg of sugarcane at the mill gate work out to Rs 193.91 with land rent and Rs 139.74/40 kg without land rent.

34. In case of Sindh, the cost of cultivating one acre of sugarcane during 2020-21 crop year is likely to be Rs 116,096, including land rent. Based on the average yield of 660 40 kgs per acre, cost of production at farm gate would be Rs 175.90 and Rs 126.66 per 40 kgs. Accounting for the marketing cost of Rs.17.50 per 40 kgs, the cost of produce at mill-gate would be Rs 194.40 per 40 kgs, inclusive of land rent and Rs 145.16 per 40 kgs without land rent.

Table-6: Average farmer cost of production of sugarcane in Punjab: 2019-20 and 2020-21

Item	Unit	2019-20 crop	2020-21 crop	Increase/ decrease in 2020-21 over 2019-20
Punjab				
1. Cost of production	Rs./ acre	116,188	122,786	6,598
2. Yield	40 Kg/ acre	688.63	700.00	11.37
3. Cost of production at farm level				
i. With land rent	"	168.72	175.41	6.69
ii. Without land rent	"	121.53	121.24	-0.29
4. Marketing charges	"	18.00	18.50	0.50
5. Cost of production at mill gate				
i. With land rent	"	186.72	193.91	7.19
ii. Without land rent	"	139.53	139.74	0.21
Sindh				
1. Cost of production	Rs./ acre	109,974	116,096	6,122
2. Yield	40 Kg/ acre	630	660	30
3. Cost of production at farm level				
i. With land rent	"	174.63	175.90	1.27
ii. Without land rent	"	129.90	126.66	-3.24
4. Marketing charges	"	18.00	18.50	0.50
5. Cost of production at mill gate				
i. With land rent	"	192.63	194.40	1.77
ii. Without land rent	"	147.90	145.16	-2.74

Source Annex-IV and V.

- Sindh

7.1 Cost of Major Operations

35. The information on cost of major operations, share in the total cost and difference between current year and the previous year in cultivation of sugarcane in the Punjab and Sindh is presented in Table-7 below:

Table-7: Cost of Major Items of Sugarcane: 2019-20 and 2020-21 Crops

Major operation	2019-20		2020-21		Changes in 2020-21 over 2019-20 Difference
	Rs/acre	% of total cost	Rs/acre	% of total cost	
Punjab					
1. Land and seed bed preparation	9851.9	8.48	10389.0	8.46	537.1
2. seed and sowing operations	14,000.0	12.05	15,000.0	12.22	1000
3. Plant protection and interculture	4,581.5	3.94	4,875.0	3.97	293.5
4. Irrigation	8,320.0	7.16	8,641.2	7.04	321.2
5. Fertilizer & FYM including TPT & app	20,151.3	17.34	19,273.6	15.70	-877.7
6. Land rent	32,500.0	27.97	37,916.7	30.88	5416.7
7. Harvesting and stripping, binding, loading	15,149.8	13.04	15,400.0	12.54	250.2
8. Others	11,633.6	10.01	11,290.3	9.20	-343.3
9. Gross cost/ acre	116,188.0	100.00	122,785.8	100.00	6597.8
Sindh					
1. Land and seed bed preparation	10,398.0	9.48	11,024.0	9.52	626.0
2. seed and sowing operations	19,798.0	18.04	20,165.0	17.41	367.0
3. Plant protection and intercultur	8,350.0	7.61	8,895.0	7.68	545.0
4. Irrigation	3,370.0	3.07	3,649.0	3.15	279.0
5. Fertilizer & FYM including TPT & app	16,964.0	15.46	16,744.0	14.45	-220.0
6. Land rent	28,166.7	25.67	32,500.0	28.05	4333.3
7. Harvesting and stripping, binding, loading	10,705.8	9.76	11,220.0	9.69	514.2
8. Other cost	11,971.1	10.91	11,649.2	10.06	-321.9
9. Gross cost	109,723.6	100.00	115,846.2	100.00	6122.6

- Notes: 1. Others include mark-up, management, land tax, drainage cess and expected escalation in the cost of selected items.
2. Figures in parenthesis are per cent shares in total cost.

- Punjab

36. As per summary information in Table-7, land rent is the major constituent of the cost of cultivation of sugarcane for the 2020-21 crop in the Punjab, accounting for 30.88 per cent. The other important components are: Fertilizer & FYM including TPT & app (15.70 per cent), Harvesting and stripping, binding, loading (12.54 per cent), seed and sowing operations (12.22 per cent), Others (9.20 per cent), irrigation (7.09 per cent) and Plant protection and interculture (3.97 per cent).

37. The changes in cost of different operations, resulting in an increase of Rs. 6597.8 per acre cost of sugarcane 2020-21 crop over that of 2019-20, mainly due to increase of land rent Rs 5416.7 per acre followed by Rs 1000 per acre increase in seed and sowing operations.

- **Sindh**

38. During 2020-21 crop year, the major components of the cost of cultivation of sugarcane, in Sindh, have followed the same pattern of the Punjab. The major component are land rent (28.05 per cent), seed and sowing operations (17.41 per cent), Fertilizer & FYM including TPT & app (14.45 per cent), Other costs (10.06 per cent), Harvesting and stripping, binding, loading (9.69 per cent), Land and seed preparation (9.52 per cent), Plant protection and interculture (7.68 per cent) and Irrigation (3.15 per cent), etc.

39. The increase of Rs 6122.6 per acre in the cost of cultivation of sugarcane in Sindh over last year's corresponding cost is primarily attributed to increase in land rent Rs 4333.3 and Land and seed bed preparation Rs 626 per acre.

8. **NOMINAL AND REAL INDICATIVE / MARKET PRICES OF SUGARCANE**

40. The Real price of a commodity is the price achieved by removing the inflationary effect from its nominal price. The resultant price of that commodity reflects its real value. It represents increase or decrease in purchasing power of the respective commodity against the base year level. In the following text, an analysis of the indicative and market prices of sugar has been carried out. This analysis is based on the prices of sugarcane during 2015-16 to 2019-20. Discussing below indicates the province-wise trends in nominal and real terms.

8.1 **Nominal and Real Indicative and Market Prices of Sugarcane in Punjab**

41. The analysis of indicative and market prices of sugarcane for the Punjab province during 2015-16 to 2019-20 is given in the Table-10.

42. The nominal indicative prices of sugarcane in the Punjab remained unchanged for longer part of the period under review. It only increased by Rs 10/40 kgs in 2019-20. During the analysis period, the Consumer Price Index (CPI), the most commonly used for measurement of inflation in the economy has escalated by 30.33 per cent. Thus a decreasing trend is observed in real indicative prices of sugarcane throughout the period against the base year level and the corresponding nominal indicative price mainly due to the higher CPI which was increasing continuously.

Table-8: Nominal and Real Indicative & Market Prices of Sugarcane Realized by the Growers in the Punjab: 2015-16 to 2019-20

Crop year	Nominal Prices		Consumer Price Index (CPI)***	Real Prices	
	Indicative *	Market **		Indicative	Market
	--- Rs per 40 kgs ---		2015-16=100	--- Rs per 40 kgs ---	
1	2	3	4	5=(2/4)x100	6=(3/4)x100
2015-16	180	180	100.00	180.00	180.00
2016-17	180	180	104.81	171.74	171.74
2017-18	180	145	109.72	164.05	132.15
2018-19	180	200	116.35	154.71	171.90
2019-20	190	220	130.33	145.78	168.36

Notes: * Indicative price of sugarcane at mill-gate fixed by the Provincial Government.

** Prices of sugarcane actually realized by the growers reported during the API's field survey.

*** CPI 2007-08 base year series converted into Base year 2015-16.

Sources: - 1. Price Policy Report for Sugarcane by API (various issues).

2: Pakistan Economic Survey, 2019-20

43. As far as the nominal market price of sugarcane is concerned, it remained at same level in 2016-17, however, it declined to Rs.145 in 2017-18. In next couples of years 2018-19 and 2019-20, the nominal market price showed upward trend and reached at Rs 220 per 40 kgs. However, the real market price remained below the nominal market price during the period under review.

8.2 Nominal and Real Indicative Prices of Sugarcane in Sindh

44. The nominal and real indicative and market prices of sugarcane in Sindh for the period 2015-16 to 2019-20 are displayed in Table-11.

45. During the period, nominal indicative prices in Sindh gradually increased from Rs 172 per 40 kgs in 2015-16 to Rs 192 per 40 kgs in 2019-20. This counts to 11.63 per cent increase. Market price usually should be higher than the indicative price. Real indicative price, however, followed a different pattern that of the nominal indicative price declining consistently.

46. As far as the nominal market price of sugarcane is concerned, it declined gradually from Rs.182 per 40 kgs in 2016-17 to Rs 130 per 40 kgs in 2017-18 but increased again in 2018-19 to Rs 215 and to Rs 220 per 40 kgs in 2019-20, mostly in upper Sindh. The real market price remained below the nominal market price throughout the period, under review.

Table-9: Nominal and Real Indicative & Market Prices of Sugarcane Realized by The Growers in Sindh:2015-16 to 2019-20

Crop year	Nominal Prices		Consumer Price Index (CPI)***	Real Prices	
	Indicative*	Market**		Indicative	Market
	---- Rs per 40 kgs ----		2015-16=100	---- Rs per 40 kgs ----	
1	2	3	4	5=(2/4)x100	6=(3/4)x100
2015-16	172	191	100.00	172.00	191.00
2016-17	182	182	104.81	173.65	173.65
2017-18	181	130	109.72	164.97	118.48
2018-19	182	215	116.35	156.42	184.79
2019-20	192	220	130.33	147.32	168.80

Notes: * Indicative price of sugarcane at the mill gate fixed by the Provincial Govt.
 ** Prices of sugarcane actually realized by the growers collected through the API field survey.
 *** CPI 2007-08 base year series converted into Base year 2015-16.

Sources: - 1. Price Policy Report for Sugarcane by API (various issues).
 2. Pakistan Economic Survey, 2019-20

47. It may be observed from the above data that CPI consistently increased during the reference period. Nominal prices have also evidenced a continuous improvement. One striking feature of market prices is that it declined by 0.55 per cent in 2018-19 as compared to 2017-18, which reflects that market is not perfect and the growers may face a higher risk factor for losing returns from their produce. The higher the CPI, the lower the real value of the commodity whether at indicative or the Market price. Hence, it may be concluded that to ensure flow of smooth returns to farmer, the inflationary trend needs to be arrested.

9. COMPARATIVE ECONOMICS OF SUGARCANE AND COMPETING CROPS

48. Resource allocation among the competing enterprises is primarily governed by the economic considerations and reflected in their gross cost, gross income, gross margin, net income, output-input ratio, etc.

49. Sugarcane is planted in the irrigated regions of the country and being an annual crop, it competes for land, water and other farm resources with both 'kharif' and 'rabi' crops. Economics of sugarcane and competing crops/ crop combinations has been analyzed in terms of output prices received by growers and input prices paid by growers during the 2019-20 crop year. Detail of the analysis is presented for the Punjab and Sindh provinces in Annex-VI A summary of analysis against various economic indicators is provided in Table-10 and Table-11 and results of the analysis are briefly discussed in the following paragraphs.

Table -10: Economics of Sugarcane and Competing Crops at Prices Realized by the Growers for 2019-20 crop in Punjab Province

Competing crops/ combinations	Output/ input ratio	Gross revenue per		
		Rupee of purchased inputs cost	Day of crop duration	Acre inch of irrigation water used
		----- Rupees -----		
1. Sugarcane	1.20	3.51	353	2898
2. Cotton + wheat	1.10	3.44	319	3941
3. Cotton + sunflower	1.11	3.23	330	3151
4. Basmati + wheat	1.09	2.67	338	1738
5. Basmati + sunflower	1.10	2.55	351	1579
6. IRRI + wheat	1.04	2.71	328	1596
7. IRRI + sunflower	1.05	2.58	341	1461

Source: Annex-VI.

- Punjab

50. The table-10 above indicates that growers' returns to overall investment based on the prices received by growers against the indicative price announced by the provincial government, remained higher for sugarcane, which performed better than the entire crop combinations. Only cotton combinations could compete with sugarcane in terms of returns to irrigation water. Similarly, sugarcane also out-competed both Basmati and IRRI combinations in terms of entire indicator analysis.

51. During 2019-20, sugarcane farmers were reported receiving relatively better prices. The Government and the Courts of Law have been intervening at various levels for resolving the issue of payments to growers.

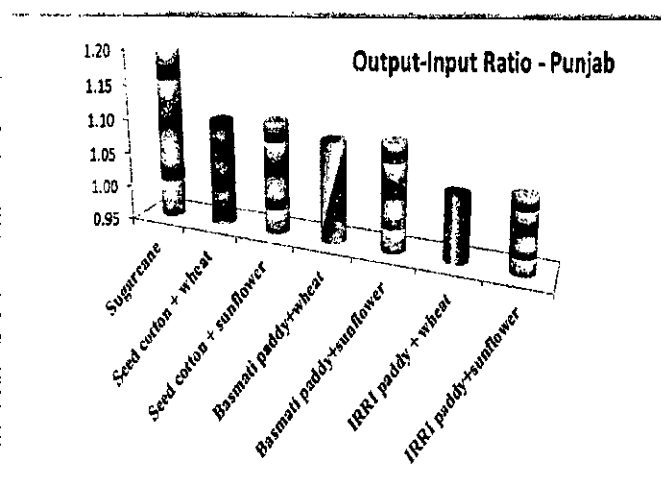


Fig-5: Output-Input Ratio of Sugarcane in Punjab

- Sindh

55. Sugarcane growers, in Sindh too, have been largely reported receiving the prices better than the indicative price announced for the year 2019-20. Presuming that the farmers received the indicative price, the analysis presents a favourable

situation for Sugarcane performing better than the competing crops, especially in terms of output-input ratio and returns to purchased inputs. However, wheat and cotton remained better than sugarcane in giving returns to grower in rest of economic indicators.

Table -11: Economics of Sugarcane and Competing Crops at Prices Realized by the Growers for 2019-20 Crop in Sindh

Crop/ crop combination	Output-input ratio	Gross revenue per		
		Rupee of purchased inputs' cost	Day of crop duration	Acre inch of irrigation water used
		----- Rupees -----		
1. Sugarcane	1.16	3.43	261	1792
2. Cotton + wheat	1.11	3.35	343	4798
3. Cotton + sunflower	1.08	3.01	309	3240
4. IRRI + wheat	1.10	3.29	314	1664
5. IRRI + sunflower	1.07	3.01	274	1266

Source: Annex-VI.

52. In terms of returns to crop duration, sugarcane performed low against all the combinations except IRRI+sunflower. Hence, Sugarcane performed better than IRRI combinations in terms of returns to irrigation water, but its performance remained low against cotton combinations. Sugarcane in Sindh, out competed entire crop combinations in terms of returns to purchased inputs.

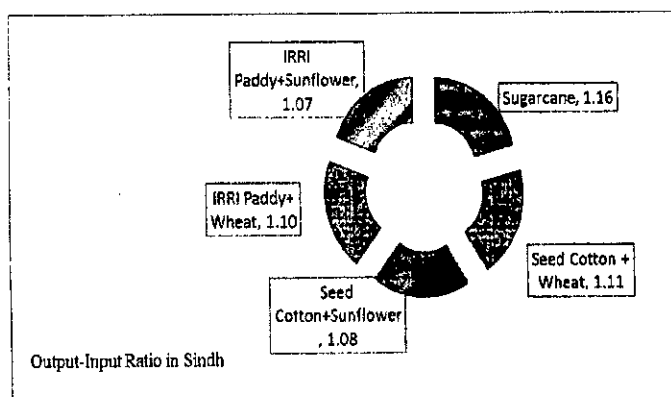


Fig-6: Output-Input Ratio of Sugarcane in Sindh

9.1 Economics of Sugarcane: Inter Provincial Comparison

53. In view of its longer duration, sugarcane crop in the Sindh province requires more water and other inputs as compared to Punjab.

54. The lower yield of Sindh by 10 per cent over Punjab may be explained in terms of relatively lowest use of inputs. The cost incurred on purchased inputs other than chemical fertilizers is relatively lesser in Sindh i.e 8 percent as compared to the Punjab. Hence, irrigation water is also applied on higher side in Sindh (48 percent). The crop duration is longer in Sindh by 24 percent as compared to Punjab.

55. Chemical fertilizers are used on higher side in Sindh by 86 per cent in nitrogenous and by 15 per cent in phosphate ingredients.

Table-12: Input Use Level and Yield of Sugarcane in Sindh Vs Punjab: 2019-20 Crop

Item	Unit	Sindh	Punjab	Difference of the Sindh province over Punjab (%)
Crop duration	Crop day	488	394	23.86
Irrigation water	Acre inch	71	48	47.92
Purchased inputs other than fertilizer	Rs./ acre	20678	21507	-8.29
Fertilizer Use:				
• N	Nutrients kg/acre	104	56	85.71
• P	„	39	34	14.71
Crop yield	40 kg/ acre	625.49	688.63	10.09

10. IMPACT OF INCREASE IN SUGAR PRICE ON CONSUMER PRICE INDEX (CPI)

56. Sugar is one of the important items in average household budget. Sugar is also included in the basket of goods used in estimating the Consumer Price Index (CPI). Any change in sugar price affects the household budget and CPI. The impact of change in the price of sugar has been worked out against the CPI and annual expenditure and summary of the results is given in Table-15

10.1 Impact on CPI

57. The changes in CPI as the result of increase in sugar price over the base price is given in Table-15.

58. It is evident from the Table-15 that every increase of Re 1 per kg over the average price of Rs 75.27 per kg is expected to raise the CPI by 0.310 per cent, provided other things remaining the same. Accordingly, the CPI is likely to increase by 0.325 and 0.372 per cent, if sugar price is increased by Rs 2 and Rs 5 per kgs..

Table-13: Impact of Increase in Sugar Price on CPI and Household Expenditure

Sugar price	Rise in CPI	Increase in annual expenses on the basis of average per capita sugar availability @ 24.87 kgs per year	
		Per person	Per household
Rs per kg	Per cent	----- Rupees -----	
62.69 Base price(15-16)			
75.27 *Aug,2020 price			
76.27	0.310	24.87**	155.88
77.27	0.325	49.74	310.38
78.27	0.341	74.61	465.57
79.27	0.356	99.48	620.76
80.27	0.372	124.35	775.94
81.27	0.387	149.22	931.13
82.27	0.403	174.09	1086.3
83.27	0.418	198.96	1241.5
84.27	0.434	223.83	1396.7
85.27	0.449	248.30	1549.4

Note: * Average Price for the month of August 2020 was Rs 75.27 per kg
Average size of household comprises 6.24 members (2018-19)
** API balance sheet method 24.87 per person taken from Annex-XI

Sources:

1. Pakistan Bureau of Statistics (PBS), Islamabad
2. Annex-XI

10.2 Impact on Household Expenditure

59. According to the Household Integrated Economic Survey (HIES) during 2018-19 by the PBS, average household in Pakistan consists of 6.24 members. The annual per capita availability of sugar based on the domestic Balance Sheet Method has averaged at 24.87 kgs per annum, the impact of selected increases in sugar price on the average Household Expenditure has been presented in table above. It may be seen that every increase of Re 1 in sugar price over the average level of 75.27 per kg would raise the CPI by 0.310 per cent. In addition, the per head and average household expenditure would increase by Rs 24.87 and Rs 155.88, respectively per annum, with rise in sugar price by Re 1 per kg, other things remaining the same. Accordingly, an increase of Rs 2 and Rs 5 over the base level would increase the per head expenditure by Rs 49.74 and 124.35 per annum and average house expenditure by Rs 310.38 and Rs 775.94 per annum.

11. ECONOMIC EFFICIENCY OF SUGARCANE PRODUCTION

60. Measurement of economic efficiency of a crop requires measurement of performance of different resources employed in production of that crop. Briefly, it helps assess the justification for putting national resources in production of that crop.

61. There are three widely accepted measures of economic efficiency namely; Nominal Protection Coefficient (NPC), Effective Protection Co-efficient (EPC) and Domestic Resource Cost Co-efficient (DRC). These efficiency measures are studied both in export as well as import perspective. Analysis in export context is based on export parity price of the concerned crop while import substitution ability of the crop is analyzed using import parity price of that crop.

62. Sugar is an important food item in Pakistan. Sugarcane provides raw material for manufacturing of sugar. Accordingly, it is very necessary to study resource use efficiency of the crop.

63. In resource use efficiency, we compare cumulative effect of cost of production of the crop and its import and export parity prices against the established economic efficiency yardsticks i.e Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC) and Domestic Resource Cost (DRC) Coefficients.

64. Here efficiency is the comparison of crop revenues against its cost of production. Though profit is very important consideration from farmer point of view to sustain a crop but at the same time, viability of a crop to justify national resources (land, labour, capital, entrepreneurship skills) employed in its production is also equally important from social point of view. It needs to be mentioned here that in the former case, cost of production is used alongwith domestic private market price of the crop and inputs used in its production while for the later the private (market) prices are transformed into social with the help of corresponding import and export parity prices of the crop.

65. In the following paragraphs, above mentioned three parameters of efficiency i.e NPC, EPC and DRC are described in more detail.

11.1 Nominal Protection Coefficient (NPC)

66. NPC is the ratio of the domestic market price to the social price of a commodity. It examines the impact of domestic market price of the crop ignoring distortions in the input prices. As a rule of thumb, if NPC is greater than one it means that local producers are protected through produce pricing policy. If it is less than one, it implies implicit taxation to growers rather than

protection to them. Implicit taxation to a crop indicates outflow of resources from that crop to other sectors of the economy.

67. Empirical estimates of NPCs for sugarcane are provided in Table-1 below. Before describing Nominal Protection Coefficients (NPCs) under import and export scenarios it seems pertinent to refer to fundamental procedures of deriving price of sugarcane equivalent to international price.

68. For this analysis, NPC estimates are estimated under import and export scenarios both for Punjab and Sindh provinces. For import scenario analysis, corresponding import parity price and for export scenario analysis relevant export parity price of sugarcane in Pakistan is used.

69. Under import scenario we calculate this price by converting cif (international price) at Karachi port into domestic currency and then by adding port handling charges and other incidentals to it to shift imported sugar to sugarcane producing districts of Punjab and Sindh.

Table - 14 Nominal Protection Coefficients for Sugarcane in Punjab and Sindh

Year	PUNJAB		SINDH	
	NPC		NPC	
	Under import scenario	Under export scenario	Under import scenario	Under export scenario
2013-14	1.28	1.77	1.24	1.71
2014-15	1.48	2.15	1.61	2.34
2015-16	1.35	1.88	1.40	2.00
2016-17	1.36	1.88	1.24	1.70
2017-18	1.29	1.73	1.24	1.70
2018-19	1.04	1.21	1.00	2.11

Source: For NPC, Annex-VII, IX and Annex-XIII.

70. It may be observed from data produced in Table-14 that NPCs for both Punjab and Sindh under import as well as export situations are greater than one throughout the period under analysis. It implies that sugarcane growers are receiving relatively higher price for their cane than the corresponding parity price. However, it needs to be noticed that these coefficients are calculated assuming Rs 180/40 Kg price of sugarcane received by the growers whereas it is commonly observed during the cane disposal season that farmers sell their consignments to the middlemen where they get price less than Rs 180/40 Kg. It has been revealed during the field surveys that farmers sell their produce to middlemen relatively at lower price. Normally, middle man price is 10% less than the indicative price reason being that middleman offers them cash payment whereas sugar mills pay them somewhat late. Thus if we estimate NPC values on the

basis of middleman price, NPC values would be around one which may approximate domestic sugar price to international price.

71. However, the above coefficients show that sugarcane growers seem price protected through the indicative price of sugarcane. This may be questioned why sugarcane growers get this price protection? A valid explanation may be that sugar being an important food item, needs to be adequately available in the market. Indicative price helps continue sugarcane cultivation. Another argument may be if Pakistan becomes dependent on imported sugar, occasional shifts in international price of sugar may increase Pakistan's import burden.

11.2 Effective Protection Coefficient (EPC)

72. Unlike NPC, EPC is the ratio of the difference between revenue and cost of tradable inputs at private prices and difference between revenue and tradable inputs cost at social prices. Thus EPC is the indicator of net incentive or disincentive effect of all policies affecting prices of tradable (seed, fertilizer, pesticides, cost of tractor run operations, tube well irrigations etc) inputs and output.

73. Same rule of thumb is for EPC as it is for NPC coefficients. If EPC is higher than one, it means domestic growers of the crop have some degree of protection/ support through prices of inputs or price of output. This implies growers' profit higher than it would be without government intervention (price support). On the other side if EPC is less than one, it indicates that net effect of input and output prices reduces grower profit. In the earlier case the growers are policy protected while in the later they are implicitly taxed which discourages domestic production.

Table- 15: Effective Protection Coefficient for Sugarcane in Punjab and Sindh

Year	PUNJAB		SINDH	
	EPC		EPC	
	Under import scenario	Under export scenario	Under import scenario	Under export scenario
2013-14	1.34	2.44	1.25	2.03
2014-15	1.68	3.43	1.80	3.39
2015-16	1.45	2.60	1.47	2.51
2016-17	1.46	2.41	1.24	2.02
2017-18	1.41	2.23	1.23	1.78
2018-19	1.03	1.35	0.92	2.75

Source: Estimated from Annex-VIII.

74. Table-15 provides EPC values for Punjab and Sindh provinces under import and export scenarios. All values are found higher than one. Respective values of EPC higher than one mean that input/ output prices induce for producing more sugarcane in the country. From the referred EPC values it may be concluded that domestic production of sugar is relatively better for domestic consumption than to export because EPC values under export scenario analysis are much higher than those derived under import scenario analysis.

11.3 Domestic Resource Cost Coefficient (DRC)

75. Domestic Resource Cost (DRC) coefficient shows social cost of non-traded inputs (domestic resources like labour, interest on capital employed in the crop, management cost, harvesting charges, cost of farm yard manure, land rent etc) used in producing the commodity. In DRC, numerator is opportunity cost of non-tradable factors at social prices while denominator is the value added (crop revenue) at social prices. If value of DRC is less than one it indicates comparative advantage in domestic production of the crop. Its reason is that cost of non-tradable domestic factors like hired labour, interest on capital, farm yard manure, transportation, canal water, land rent, managerial services, land revenue and Drainage Cess is less than the corresponding import cost of these factors.

76. Domestic Resource Cost coefficients (DRCs) for present analysis are derived by using cost of production of sugarcane and import price of sugar. The estimates are produced in Table-16. In this respect detailed data on private and social profitability under import situation are produced in Annex-VII, Annex-VIII, Annex-XI and XII. And for export situation these data are produced in Annex-IX, Annexes-X, XIII and Annex-XV.

Table-16: Domestic Resource Cost Coefficients (DRCs) for Sugarcane in Punjab and Sindh Provinces

Year [1]	Under import situation		Under export situation	
	Punjab [2]	Sindh [3]	Punjab [4]	Sindh [5]
2013-14	0.58	0.76	1.06	1.24
2014-15	0.68	0.70	1.39	1.33
2015-16	0.64	1.01	1.15	1.71
2016-17	0.57	0.75	0.95	1.07
2017-18	0.55	0.80	0.87	1.15
2018-19	0.45	0.63	0.58	1.88

Sources: 1. Import situation estimates derived from Annex-VII, Annex-VIII, Annex-XI, Annex-XII
2. Export situation estimates derived from Annex-IX, Annex-X, Annex-XIII, Annex-XIV,.

77. It is observed from Table-5 that DRC values under import scenario analysis are less than one throughout the period of analysis except for Sindh, 2015-16. However, these have mixed trend under export scenario analysis. Findings in the above table support that Punjab has advantage in producing sugarcane for domestic consumption of sugar and we may save foreign exchange by substituting sugar import.

12. DOMESTIC DEMAND, SUPPLY, STOCK AND PRICES OF SUGAR

12.1 Domestic demand, supply and stocks

78. The sugar production from 2019-20 (Oct-Sept) crop has been estimated at 4.875 million tons. After accounting the opening stocks of previous year 2.060 million tons (opening stocks at the beginning of new season as on 1st October) the leftover stocks from 2018-19, and accounted for the import export the total sugar supply for 2019-20 consumption year is estimated to 6.760 million tons. Based on average per capita consumption of sugar estimated at 24.87 kgs per annum on the basis of balance method, calculated by API (Annex-XV), 15.36 kgs per annum as reported by the Household Integrated Survey 2018-19 (HIES) by PBS and 22.60 kgs per annum of world level average consumption of sugar during 2019-20. The total domestic requirement for a population of 222.23 million has been worked at 5.527, 3.413 and 5.022 million tonnes, respectively. Thus, there is an estimated 1.233, 3.347 and 1.738 million tonnes, respectively, surplus sugar available in the country based on the three criteria, as illustrated below:

Table-17: Domestic Requirement Situation of Sugar during 2019-20

S. No	Items	Per capita Consumption of Sugar Kgs/annum		
		Balance Sheet Method	HIES per capita consumption	World Average Consumption
		24.87 Kgs	15.36 kgs	22.60 kgs
-----Millions-----				
1	Opening stocks left over from 2018-19	2.060	2.060	2.060
2	Production 2019-20	4.875	4.875	4.875
3	Import	0.006	0.006	0.006
4	Export	0.181	0.181	0.181
5	Total Supply for 2019-20	6.760	6.760	6.760
6	Population during 2019-20	222.23	222.23	222.23
7	Requirement	5.527	3.413	5.022
8	Surplus/ deficit	1.233	3.347	1.738

Sources: i). Annex-XV.

ii) For production and Stocks; Ministry of Industries.

ii). for population, Economic Survey of Pakistan and projected on the basis of growth rate

12.2 Behavior of sugar prices in domestic market

79. The monthly average wholesale prices of sugar prevailing in major domestic markets of Lahore, Faisalabad, Karachi, Hyderabad and Peshawar markets during 2019 and 2020 (Jun - Dec) are presented at Annex-XIV while for the last 13 years (Oct-Sept) in Annex-XV.

80. Average monthly wholesale prices of sugar, highest and lowest price are observed between Rs 4750 to Rs 7400 in Lahore market during 2019 in the months of January to March and in the month of September respectively. During 2020 (Jan-Jun), average monthly wholesale prices ranged between Rs 7111 per 100 kgs in Faisalabad Market during month of January, 2020 to Rs 7920 per 100 kgs in Karachi markets during month of May, 2020, The overall average of sugar price at country level ranged between Rs 5350 to Rs 7792 per 100 kgs during 2019-20.

13. WORLD SUPPLY, DEMAND, STOCKS, TRADE AND PRICES OF SUGAR

13.1 Supply, demand, stocks and trade

81. The data on world balance sheet of sugar (raw equivalent) for the period of 2018-19 to 2020-21 are presented in Table-18:

Table - 18: World Balance Sheet of Sugar (Raw Equivalent): 2018-19 to 2020-21 (October - September)

Item	2018-19	2019-20 Estimated	2020-21 Projected
	-----Million tons-----		
1. Opening stocks	52.23	53.98	44.43
2. Production	179.66	166.18	188.08
3 Total supply (Item 1+2)	231.89	220.16	232.57
4. Disappearance (consumption)	172.62	171.58	177.80
5. Stock adjustment *	-0.01	-0.99	-1.06
6. End year stocks (3-4+5)	53.98	44.43	43.55
7. Trade (Export)	56.01	54.12	65.23

Note: * Including adjustment for unknown net trade.

Source: Sugar: World Markets and Trade, USDA may, 2020.

82. The world sugar production is estimated at 166.18 million tons during 2019-20, 13.48 million tons (7.73 percent) lower than the last year level of 179.66 million tons. With the addition of opening stocks of 53.98 million tons, global supply of sugar in 2019-20 were reported at 220.16 million tons (5.06 percent) lower than 2018-19. The world consumption in 2019-20 is estimated at 171.58 million tons, 0.60 per cent lower than the last year level of 172.62 million tons. End year stocks in 2019-20 are estimated at 44.43 million tons, 17.69 per cent lower than last year.

83. According to Sugar World Markets and Trade, USDA May, 2020 issues the World sugar production during 2020-21 is forecast at 188.08 million tons, 13.18 percent higher than last year's production. Accounting for the opening stocks of 44.43 million tons, global supply of sugar in 2020-21 has projected at 232.51 million tons 5.61 percent higher than 2019-20. World consumption in 2020-21 is projected at 177.80 million tons, 3.63 per cent higher than last year. End year stocks projected to decrease slightly during 2020-21 at 43.55 million tons.

13.2 International Prices of Sugar

84. International prices of raw (fob Caribbean ports) and white (fob London) sugar from 2009-10 to 2019-20 are presented in Annex-XVI.

85. Prices of both raw and white sugar have fluctuated from 2009-10 to 2019-20. During 2009-10, the prices of white sugar averaged at US \$ 574.68 per tonnes. However, this price rose sharply in next year and averaged at US \$ 711.93 per tonnes during 2010-11, the highest level of price during the period under review. From 2011-12, prices started a continuous downward trend and averaged at \$ 337.84 per tonnes in 2017-18, the lowest level of price during the period under review. In the current season 2019-20 (Oct-Jun), an upward trend is being observed and reached at \$ 358.34 per tonnes.

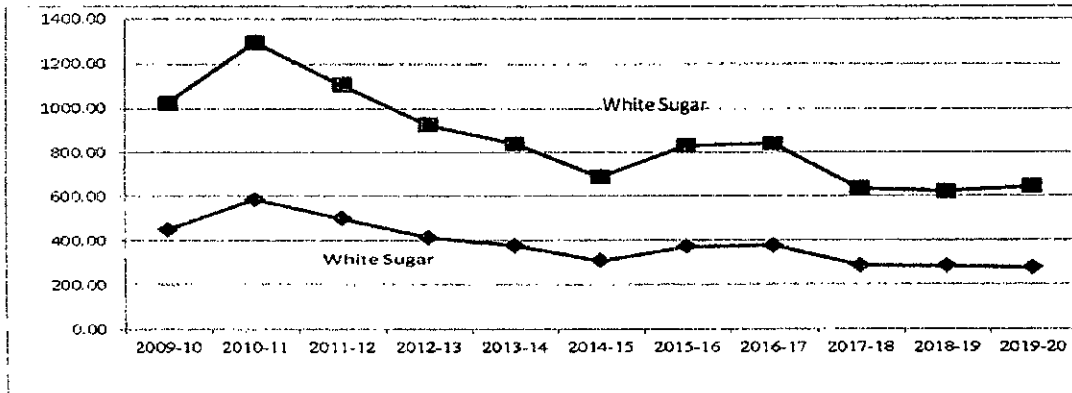


Fig-7- International prices

86. The pattern followed by the prices of raw sugar as during period under reference has been similar to that of white sugar as described above. Difference between the average annual price of raw and white sugar ranged between \$ 57.37 per tonnes to \$ 128.58 per tonnes.

14. IMPORT AND EXPORT PARITY PRICES OF SUGARCANE

87. Estimation of import parity price of a commodity is helpful in determining the opportunity cost of resources used in its domestic production while the export parity prices are helpful in ascertaining its competitiveness in international market. Since Pakistan has been importer of sugar in some years and exporter in the others, both the import and export parity prices of sugarcane have been worked out for analyzing price policy options for the next crop season.

88. Both the import and export parity prices have been calculated on the basis of white sugar price (fob London). Detailed calculations in this connection are given in Annexes XIV and XX, while the results are summarized in Table-19.

Table-19: Import/Export Parity Prices of Sugarcane as Worked Back from Average fob (London) Prices of Sugar

Average fob London prices of white sugar per tonne	Sugarcane prices (Rs/40 kgs)	
	Punjab	Sindh
Import parity		
US \$ 368.07 (June 2020)	221.77	232.74
US \$ 358.34, 2019-20 (Oct-June)	216.57	227.29
US \$ 348.03 (2017-18 to 2019-20)	211.07	221.51
Export parity		
US \$ 368.07 (June 2020)	130.18	136.62
US \$ 358.34, 2019-20 (Oct-June)	125.23	131.43
US \$ 348.03 (2017-18 to 2019-20)	119.99	125.92

Source Annexes XIV and XX.

15. MILL-GATE PRICES OF SUGARCANE BASED ON DOMESTIC WHOLE SALE PRICES OF SUGAR DURING 2018-19 CONSUMPTION YEAR

89. Sugarcane prices have also been estimated from the wholesale prices of sugar during the 2019-20 consumption year and presented in Table-17. This analysis is based on actual sucrose recovery as reported by the PSMA during 2018-19(due to current sugar crises, the sugar

recovery is not available), processing cost of sugar and Sales Tax @ 17 percent. A summary of sugarcane prices estimated under this scenario from various wholesale prices of sugar is presented in Table-20 while the details are given in Annex - XIX.

Table - 20: Sugarcane Prices Estimated from Expected Wholesale Prices of Sugar During 2019-20

Wholesale prices of sugar (Rs /Tonnes)	Sugarcane prices (Rs/40 Kgs)	
	Punjab	Sindh
Rs 65000	177.92	186.72
Rs 70000	191.60	201.08
Rs 75000	205.29	215.44
Rs 80000	218.97	229.81
Rs 85000	232.66	244.17

Source Annex-XIX

16. USE OF SUGARCANE CESS FUND

90. The former Agriculture Prices Commission (APCom) presently Agriculture Policy Institute (API) had been suggesting in the Price Policy Reports that the sugarcane cess fund which was aimed/meant for the construction and improvement of roads in the sugarmills areas, should also be utilized for research and development of sugarcane crop. Huge amounts of sugarcane cess fund are lying unutilized with the district/provincial governments, due to lack of proper coordination, planning and decision making. The Provincial Cane Commissioners are mainly responsible for regulating the affairs relating to development, marketing and processing of sugarcane in their respective provinces.

91. To strengthen sugarcane research in the Punjab, the Government of Punjab has allocated 10% of Sugarcane Cess Fund to Sugarcane Research and Development Board (SRDB), Punjab.

92. The SRDB will utilize that cess fund for both sugarcane research & development and also include operational expenditures of SRDB (salaries, POL and traveling etc.). Utilization of its budget towards sugarcane research mainly covers funding for research projects, import of germplasm (fuzz/clones) from Canal Point USA & other countries for sugarcane variety development and capacity building of scientists/researchers etc. The impact on development of sugarcane requires some time to evaluate.

17. SUGARCANE CROP RESEARCH AND DEVELOPMENT IN PAKISTAN

- Punjab

93. The Sugarcane Research Institute, (SRI), Faisalabad is an apex public sector organization working on development and release of sugarcane varieties along with production technologies.

94. The Institute has overall developed 24 commercial sugarcane varieties for general cultivation in the Punjab. These varieties occupied more than 95% of sugarcane cultivated area in the province. Varieties developed in the last ten years with characteristics are as under:

Table - 21: Varieties Developed by SRI, in Last Ten Years with their Characteristics

S.No	Variety	Year of Release	Main characteristics
1	CPF 246	2011	<ul style="list-style-type: none"> • It is medium maturing variety • Avg. yield potential: 1600 t ha⁻¹ • Avg. yield: 1200 t ha⁻¹ • Sugar recovery: 12.15% • Ratooning ability: Good • 2083 t ha⁻¹ cane yield was reported in sugarcane yield competition in the Punjab-2012
2	CPF 247	2011	<ul style="list-style-type: none"> • It is medium maturing variety • Avg. yield potential: 1500 t ha⁻¹ • Avg. yield: 1200 t ha⁻¹ • Sugar recovery: 12.25% • Ratooning ability: Good • Also good for light soils and non-lodging variety
3	CPF 248	2014	<ul style="list-style-type: none"> • It is medium maturing variety • Avg. yield potential: 1500 t ha⁻¹ • Avg. yield: 1200 t ha⁻¹ • Sugar recovery: 12.71% • Ratooning ability: Good
4	CPF 249	2016	<ul style="list-style-type: none"> • It is medium maturing variety • Avg. yield potential: 1650 t ha⁻¹ • Avg. yield: 1200 t ha⁻¹ • Sugar recovery: 12.46% • Ratooning ability: Good • Also good for saline soils and having highest yield potential

18. MARKETING OF SUGARCANE

95. Sugarcane is one of the main cash crops of Pakistan sown on vast areas throughout the country. As it cannot be stored after harvesting, so is to be processed either into gur/khandsari at the farms or crushed by sugar mills for sugar manufacture. So its marketing plays an important role in this respect. For having an upto date information in this respect, API conducted a mini survey in the main sugarcane producing areas of Punjab and Sindh. On the basis of survey results and discussion in the API Committee meetings held at Multan, Punjab on June 05,2020 and Hyderabad, Sindh on June 11, 2020. the main issues/problems faced by the farming community are briefly discussed below:

18.1 Delayed payments

96. In the normal or higher production years, the sugar industry in the beginning of the season, generally made payments to growers within two weeks but as the season progresses to the end, the payments are delayed by months and in some cases by seasons. Mills are of the view that this happens due to liquidity problem. Similarly vast majority of sugarcane growers sell their produce at the local procurement centers which are managed privately. Here though they sell relatively at lower price but they get cash immediately whereas at the mill gate they may sell at higher price but they receive payment much later from the sugar mill. Due to small harvest during 2019-20 crop, the mills has made payment promptly.

18.2 Presence of middlemen

97. Due to above mentioned situation, the role of middleman, which was increasing day by day in sugarcane business, was observed at top level. The growers sold their produce to middleman for prompt payment. Sugarcane growers are in need of immediate payments for their sale proceeds, they in order to avoid the delayed payments are compelled to sell their produce or CPRS at discount rates varying from area to area, but mostly ranging between Rs 2 – 5 per 40 kgs of cane price to the middle man. Although, current season the growers have received higher and immediately payments from middle men, this practice had caused tremendous loss to the farming sector in the past and may in future. It is, therefore, stressed that this practice of selling cane/CPRS at discount rates may be discontinued or stopped altogether. In order to improve the situation, the mills may be compelled to make the payments for sale proceeds at the earliest according to Sugarcane Factory Control ACT.

18.3 Underweight and Undue deductions

98. Underweight and undue deduction of cane at the purchase centers and mill gates were the regular complaint of cane growers. The private purchase centers and the mills agents

are very notorious in this respect. The weighbridges and scales installed at the purchase centers do not record the correct weighment. Mostly the farmers bringing cane remained unaware about the readings of these scales. The quantity underweighment and undue deduction varied from place to place and for each mill area. In current season, due to short supply and purchase war among the sugar mills have reduced both unlawful deductions. But the supervisory committees should be quite effective and vigilant against, these malpractices.

18.4 Provision of Seed of Approved Varieties

99. The sugarcane seed is required in bulk quantity, its harvesting, transportation and planting is carried out at same time and cannot be stored/ packed. Its rate of multiplication is hardly 1:10 as compared to 1:40 for wheat. The production, multiplication and distribution of quality seed of high yielding varieties at Institute level does not exist. After de-zoning, sugar mills also have stopped their cane development activities including the supply of improved seed to the growers. Resultantly, farmers generally use their commercial crop as seed without its treatment against diseases. In this regards, the API suggests the following measure:

- i. The sugar industry should provide incentive to the growers for growing cane of high sucrose varieties in the form of quality premium and Provincial Agriculture Departments should launch an aggressive campaign for educating the growers regarding the sowing of improved varieties and discouraging the cultivation of unapproved varieties.
- ii. The sugar mills should establish/ revive their Cane Development Programme either individually or collectively. These centers in collaboration with the progressive growers and sugarcane researchers should develop the sugarcane seed according to climate change.
- iii. The responsibility of production, multiplication and distribution of High Yielding Variety (HYV)/quality seed of sugarcane be assigned to the sugar mills, as they are the main beneficiaries of increased production of sugarcane. The sugar mills should also provide the technical guidance to growers for using the modern technique

18.5 Low Plant Population

100. Lack of adequate plant population remains an important factor in low productivity of sugarcane. The research on sugarcane has found that even good quality seed does not provide more than 60 per cent germination. In general, 80-100 maunds seed of thin and 100-120 maunds of thick varieties of cane is recommended for cultivating of one acre but due to manual sowing operation, it is not possible to achieve the optimum level of seed.

101. It is imperative to use the sugarcane planter and harvester to achieve the maximum production of sugarcane crop. The sugarcane planter minimizes cost of sowing, which is a labour intensive and time consuming operation.

18.6 Amendments in Sugar Factories Control Act, 1950

102. After de-zoning and emerging issues, many changes have occurred in the cane marketing system and the functioning of Sugar Factories Control Act, 1950 has become less effective. Keeping in view the current needs, it is essential that the Act may be amended in the light of emerging issues, especially for the promotion of contract system between growers & the mills.

19. VALUE-ADDITION AND VERTICAL INTEGRATION IN SUGAR INDUSTRY

103. In view of the falling trend in the world prices of sugar and large-scale investments in the domestic sugar industry it is imperative to improve the efficiency of resource use in sugarcane production and its processing. For improving the productivity in sugar processing, the requirement is not only to improve the efficiency but also value addition through vertical integration. In the wake of fast approaching globalization and WTO requirements the sugar industry would also have to go into value adding business and growers also get their share in returns.

20. IMPROVING PRODUCTIVITY

104. The raw material requirement of sugar industry comprising 89 sugar mills, with crushing capacity of about 350 thousand tonnes per day has been met through expanding acreage under sugarcane. This demand-led horizontal expansion in cane production has not only resulted in extension of sugarcane cultivation to prime land but also aggravated the water shortage. Sugarcane, a high water delta crop, poses serious competition to other important crops: cotton, rice, wheat, etc. Thus, further expansion in sugarcane area already spanning over one million hectares, given the recurring water shortages and the increasing demand for water from other crops and non-farm uses, is no more a viable option. With the increasing requirements of other food and cash crops to meet the ever expanding demand from burgeoning population, it is of utmost importance to increase the productivity of resource use in agriculture through all the possible means.

20.1 Varietal Development

105. The development of new varieties of sugarcane is a lengthy process requiring primarily the sugarcane fuzz either through its local production or imports from abroad. The poor infrastructural support for breeding work and climatic conditions in the country except in few

areas has not permitted the farmer. Moreover, the cane breeding programme has been quite limited and confined to a few centers. The programme is also constrained due to insufficient funds and land resources.

20.2 Sugarcane Seed Certification Process in Punjab

106. The sugarcane seed is required in bulk quantity, its harvesting, transportation and planting is carried out at same time and cannot be stored/ packed. Its rate of multiplication is hardly 1:10 as compared to 1:40 for wheat. Tagging is difficult for sugarcane seed. At present Punjab Seed Corporation, private seed companies or sugar mills are involved in certified sugarcane seed production, multiplication and distribution in the Punjab without tagging.

107. The Government of Punjab has started a process of newly approved sugarcane seed certification process (Seed Standards, tagging process) of FSC & RD by involving government intuitions, PSC, Sugar Mills, private seed companies etc, The implementation of the concept of certified seed (healthy ,pure, true to type and site specific) sugarcane seed production , multiplication and distributions).the Sugarcane Research Institute (SRI), Faisalabad has been given the responsibility for this process

108. The SRI, in meeting with all the stakeholders made the following decision/ recommendations:

- i. The tagging system is not practicable in case of sugarcane because it is difficult to tag or pack each unit of seed for transportation purpose. The disposal of sugarcane seed at Institute level is a big challenge
- ii. Quality seed production, multiplication and distribution of sugarcane at the level of SRI, Faisalabad may be continued in the best interest of the farming community.
- iii. Sugarcane seed multiplication and distribution process is entirely different from other crops, therefore, this process should be designed in such a way to facilitate the provisioning of pure, health and good quality seed of approved varieties to the growers.
- iv. FSC7RD may issue "Lot number" on area basis regarding pure & healthy seed to SRI, Faisalabad after fulfilling certification/ inspection process.

20.3 Balanced Use of Fertilizers

109. Chemical fertilizers play an important role in enhancing crop productivity but real key for getting maximum returns from the investment on fertilizers is their balanced and timely application. Overtime, though fertilizer use has increased but due to widening of NP ratio productivity gains have been sub-optimal. The survey reports on use of fertilizers have shown that only a small fraction of cane growers have adopted balanced use of fertilizers. This imbalance in nutrient application adversely affects the per hectare yield of sugarcane as well as quality of the produce.

21. SUGARCANE YIELD AMONG COMPETING COUNTRIES

110. Global sugarcane during 2019 occupied an area of around **26,777** thousand hectares with a total production of **11,945,748** thousand tonnes. The world top 25 producing countries contribute 93.26 per cent of total area and 90.01 per cent of total production as narrated in Tables-22-23.

**Table-22: Major Sugarcane Producing Countries (Area) of the World:
2017 Crop**

S.No.	Country	Area (000)ha	Per cent Share in World area
1	Brazil	10081	37.65
2	India	5061	18.90
3	Thailand	1835	6.85
4	China, mainland	1414	5.28
5	Pakistan	1040	3.88
6	Mexico	796	2.97
7	Argentina	476	1.78
8	Colombia	458	1.71
9	Indonesia	444	1.66
10	Australia	433	1.62
11	Philippines	379	1.42
12	United States of America	370	1.38
13	South Africa	299	1.12
14	Guatemala	270	1.01
15	Viet Nam	233	0.87
16	Cuba	209	0.78
17	Myanmar	182	0.68
18	Bolivia (Plurinational State of)	175	0.65
19	Egypt	141	0.53
20	Cameroon	136	0.51
21	Ecuador	122	0.45
22	Iran (Islamic Republic of)	113	0.42
23	Dominican Republic	104	0.39
24	Paraguay	103	0.38
25	Madagascar	100	0.37
	Total of 25 countries	24973	93.26
	World Total	26777	100.00

Source: World statistics year book 2019

111. In terms of sugarcane **area**, Brazil is on the top with 10,081 thousand hectares followed by India with 5,061 thousand hectares and Thailand, China mainland, with 1835, 1414 thousand

hectares. Pakistan with 1040 thousand hectares, lies at 5th position in this regard sharing 3.88 per cent of global acreage.

112. In terms of sugarcane production, Brazil is on the top with 752895 thousand tonnes followed by India with 405,416 thousand tonnes while Thailand and China with 131,002, 109,388 thousand tonnes respectively. However, Pakistan retains at 5th position in sugarcane production of the world ranking (Table-23).

**Table-23: Major Sugarcane Producing Countries (Production) of the World:
2019 Crop**

S.No.	Country	Production in (000)tonnes	Per cent Share in World area
1	Brazil	752895	38.69
2	India	405416	20.84
3	Thailand	131002	6.73
4	China, mainland	109388	5.62
5	Pakistan	66880	3.44
6	Mexico	59334	3.05
7	Colombia	32663	1.68
8	Australia	32415	1.67
9	Indonesia	29100	1.50
10	Guatemala	29087	1.49
11	United States of America	28973	1.49
12	Philippines	20719	1.06
13	South Africa	19482	1.00
14	Argentina	17653	0.91
15	Egypt	16316	0.84
16	Viet Nam	15270	0.78
17	Myanmar	11846	0.61
18	Peru	10929	0.56
19	Bolivia (Plurinational State of)	9558	0.49
20	Iran (Islamic Republic of)	9285	0.48
21	Ecuador	9258	0.48
22	Cuba	8725	0.45
23	Nicaragua	7372	0.38
24	El Salvador	7178	0.37
25	Paraguay	5819.5	0.30
	Total of 25 countries	1751325	90.01
	World Total	1,945,748	100.00

Source: World statistics year book 2019

113. In terms of yield kgs per hectare, Peru lies at the top with 12,548.76 thousand kgs per hectare followed by Egypt 11,574.27 thousand kgs per hectare and Senegal, Guatemala, Malawi

with 11,325.47, 10,767.25, 10,756.13 thousand kgs per hectare correspondingly. It is an upsetting situation that Pakistan ranks at 41st in terms of yield with 6,432.15 thousand kgs per hectare, which is far below the international average while India lies at 33rd position with 69.74 tonnes per hectare. The world average yield of sugarcane is 7,664.79 thousand kgs (76.65 tonnes per hectare) (Annex-XXII).

22. MEASURES FOR IMPROVING PRODUCTIVITY

114. In view of high-water requirement of sugarcane and increasing water shortages, horizontal expansion of this crop is not feasible. Hence, the enhanced productivity is the only way forward to maintain the regular supply of sugarcane as raw material to 2nd largest agro-based sugar industry of Pakistan. API has recommended the following productivity enhancement measures.

22.1 Varietal Development

115. The government should pursue the PSMA and provincial research institutes to emphasize on cane varietal development. Provincial governments should take strict measures to implement the ECC decision regarding the release and utilization of "Cess Fund" in this regard.

22.2 Improved Cultural practices

116. Provincial Departments of Agriculture Extension should take the following steps in this regard:

- Land should be prepared by deep ploughing at least after every two years. The soil should be discked.
- Modernizing technology for improving productivity and competitiveness in the sugar industry.
- Need for improvement in efficiency and productivity of irrigation water and fertilizer.
- Chemicals and bio-control agents for the management of pests and diseases be introduced.
- Promote use of deep tillage for seedbed preparation for sugarcane cultivation.
- Practice recommended 'row to row' distance in sugarcane fields for effective weed control.
- Use healthy seed of improved varieties of fresh crop of sugarcane and discourage cultivation of un-approved varieties.
- Motivate farmers for 'Hot Water Treatment' of sugarcane sets for disease control.
- To conserve water, there is a need for improvement in efficiency and productivity of irrigation water.
- Apprise the farmers for achieving the desirable plant population per acre.
- Awareness to the farmers for using press mud to improve soil fertility.

- Educate sugarcane growers for using different fertilizers in recommended dosage.
- Well decayed farmyard manure (FYM) should be applied prior to land preparation.
- Apprise the growers about use of weedicides for controlling weeds.

22.3 Biological Control

117. The government should emphasize PSMA and provincial research institutes to establish Integrated Pest management (IPM) labs for rearing predators for disease control in sugarcane crop.

22.4 Role of Sugar Industry in Cane Development

118. To promote sugarcane crop, the sugar industry of Pakistan should:

- Take responsibility for a campaign against pest and plant diseases, but on a limited scale.
- Study soils in sugarcane producing areas and to relate these to crop management.
- Supply press mud free of cost to sugarcane growers to ensure adequate amounts of organic matter in the soil to sustain necessary fertility level to improve yield of the sugarcane crop
- Investigate the agronomic problems of sugarcane production and soil conditions
- Take concrete measures to multiply and disseminate high sucrose varieties along-with necessary extension work for development of sugarcane crop.
- Take immediate steps to increase supply of improved varieties of cane seed among the farmers in addition to government efforts in this regard.

22.5 Low Sugar Recovery

121. Provincial and PARC Research Institutes should determine the reasons for low sugar recovery. The comparison with the world sugar recovery rate, which is on average lower than 10 percent, indicates that efforts are required to enhance this percentage, in order to increase sugar production. The best practices in Brazil and other developed countries need to be adopted and new technologies introduced for achieving countries of scale and comparative advantage in the export market.

22.6 Commercial Varieties and Their Yield Potential in the Punjab, Sindh and KP

122. Cane varieties play a pivotal role in improving yield and recovery of sugar cane. The yield of cane is important for economic up lift of growers and the sugar recovery of variety is the Single most dominant factor that affect the economic viability of sugar industry. Improved and high yielding of sugar varieties are one of the major sources through which cane and sugar yield per unit area cane be increased. Varieties should be cultivated according to the areas.

123. The yield potential of sugarcane varieties in the Punjab range between 80 and 130 tons per hectare. The highest yield potential of HSF-240, HSF-242 and CPF-243, varieties is estimated respectively at 130,108 and 102 tons per hectare and highest sugar recovery percentage are 12.7, 12.5 and 12.4 of the varieties CP-77-400, CPF-243, CPF-237, HSF-240, CPF-247. If these varieties are adopted for vast cultivation in their specified field areas with their recommended production technology and timely supply of inputs and application, the yield per hectare would definitely improve at the country level. List of the varieties have been presented in the (Annex-XXIII).

124. Yield of High yielding cane varieties evolved by Research Institutes in Sindh range between 170 and 200 tons per hectare and highest recovery varieties is Thatta-10 and LRK-2001 on the top with 11 per cent sugar recovery. The highest yield potential of Ghulabi-95 is estimated at 200 tons per hectare and in KPK, high yielding variety is CP-77-400 estimated at 100 tons per hectare with 12.7 per cent sugar recovery.

23. ACKNOWLEDGEMENT

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ANNEX-I

**PROVINCE-WISE AREA ,PRODUCTION AND YIELD OF SUGARCANE
IN PAKISTAN : 2009-10 TO 2019-20**

YEAR	PUNJAB	SINDH	KPK	BALUCHISTAN	PAKISTAN
AREA					
----- 000 hectares -----					
2009-10	607.4	233.9	100.8	0.7	942.8
2010-11	672.2	226.4	88.4	0.6	987.6
2011-12	761.2	189.7	105.9	0.7	1057.5
2012-13	767.7	253.7	106.7	0.7	1128.8
2013-14	756.8	297.6	117.4	0.7	1172.5
2014-15	710.6	316.7	112.5	0.7	1140.5
2015-16	705.4	312.8	112.7	0.7	1131.6
2016-17	777.8	320.5	118.6	0.7	1217.6
2017-18	859.1	333.3	148.5	0.9	1341.8
2018-19	710.6	279.5	111.0	0.9	1102.0
2019-20	643.4	288.8	109.4	0.9	1042.5
YIELD					
----- Tonnes per hectare -----					
2009-10	51.57	57.74	44.72	50.86	52.37
2010-11	55.76	60.81	45.59	51.33	56.00
2011-12	56.35	56.87	44.23	44.00	55.22
2012-13	55.99	62.93	44.71	45.00	56.48
2013-14	57.75	61.70	45.67	46.00	57.54
2014-15	57.80	52.46	45.40	45.14	55.09
2015-16	59.50	57.49	48.79	45.29	57.87
2016-17	63.79	63.05	47.46	45.14	61.99
2017-18	64.10	61.84	51.25	48.22	62.11
2018-19	63.19	59.72	49.84	49.22	60.96
2019-20	67.37	59.67	52.60	50.22	63.67
PRODUCTION					
----- 000 Tonnes -----					
2009-10	31324.0	13505.4	4507.9	35.6	49372.9
2010-11	37481.0	13766.4	4030.3	30.8	55308.5
2011-12	42893.0	10788.3	4684.3	30.8	58396.4
2012-13	42982.0	15966.2	4770.2	31.5	63749.9
2013-14	43704.0	18362.5	5361.4	32.2	67460.1
2014-15	41074.3	16613.8	5107	31.6	62826.7
2015-16	41968.2	17984.3	5498.3	31.7	65482.5
2016-17	49613.0	20208.9	5628.7	31.6	75482.2
2017-18	55067.5	20611.9	7610.0	43.4	83332.8
2018-19	44906.3	16691.3	5532.0	44.3	67173.9
2019-20	43346.6	17233.8	5754.0	45.2	66379.6

Sources:

Agricultural Statistics of Pakistan, MINFA, Islamabad, various issues.

ANNEX-II

**PROVINCE-WISE AREA ,PRODUCTION AND YIELD OF SUGARCANE
IN PAKISTAN : 2009-10 TO 2019-20**

YEAR	PUNJAB	SINDH	KPK	BALOCHISTAN	PAKISTAN
AREA ----- 000 acres -----					
2009-10	1500.9	578.0	249.1	1.7	2329.7
2010-11	1661.1	559.5	218.4	1.5	2440.4
2011-12	1881.0	468.8	261.7	1.7	2613.2
2012-13	1897.1	626.9	263.7	1.7	2789.4
2013-14	1870.1	735.4	290.1	1.7	2897.4
2014-15	1756.0	782.6	278.0	1.7	2818.3
2015-16	1743.1	773.0	278.5	1.7	2796.3
2016-17	1922.0	792.0	293.1	1.7	3008.8
2017-18	2122.9	823.6	367.0	2.2	3315.7
2018-19	1756.0	690.7	274.3	2.2	2723.1
2019-20	1589.9	713.7	270.3	2.2	2576.1
YIELD ----- Tonnes per acre -----					
2009-10	20.87	23.37	18.10	20.58	20.73
2010-11	22.56	24.61	18.45	20.77	21.60
2011-12	22.80	23.01	17.90	17.81	20.38
2012-13	22.66	25.47	18.09	18.21	21.11
2013-14	23.37	24.97	18.48	18.62	21.36
2014-15	23.39	21.23	18.37	18.27	20.31
2015-16	24.08	23.27	19.74	18.33	21.35
2016-17	25.81	25.52	19.21	18.27	22.20
2017-18	25.94	25.03	20.74	19.51	22.80
2018-19	25.57	24.17	20.17	19.92	22.46
2019-20	27.26	24.15	21.28	20.32	23.26
PRODUCTION ----- 000 Tonnes -----					
2009-10	31324.0	13505.4	4507.9	35.6	49372.9
2010-11	37481.0	13766.4	4030.3	30.8	55308.5
2011-12	42893.0	10788.3	4684.3	30.8	58396.4
2012-13	42982.0	15966.2	4770.2	31.5	63749.9
2013-14	43704.0	18362.5	5361.4	32.2	67460.1
2014-15	41074.3	16613.8	5107	31.6	62826.7
2015-16	41968.2	17984.3	5498.3	31.7	65482.5
2016-17	49613.0	20208.9	5628.7	31.6	75482.2
2017-18	55067.5	20611.9	7610.0	43.4	83332.8
2018-19	44906.3	16691.3	5532.0	44.3	67173.9
2019-20	43346.6	17233.8	5754.0	45.2	66379.6

Sources: Agricultural Statistics of Pakistan, MINFA, Islamabad, various issues.

DISTRICT-WISE AREA, YIELD AND PRODUCTION OF SUGARCANE
AVERAGE OF 2017-18 TO 2019-20

ANNEX-III

S.No	Province/ District/ Agency	Area	Production	Share in total production	Yield	S.No	Province/ District/ Agency	Area:	Production:	Share in	Yield
								Yield:	Yield:	total	total
						<p align="center">000 ha 000 tonnes Tonnes/hectare</p>					
S.No	Province/ District/ Agency	Area	Production	Share in total production	Yield	S.No	Province/ District/ Agency	Area	Production	Share in total production	Yield
PUNJAB						KHYBER PAKHTUNKHWA					
1	R.Y.Khan	178.10	13104.00	18.07	73.68	1	D.I Khan	38.88	2434.34	3.36	61.05
2	Faisalabad	89.35	5514.56	7.61	61.72	2	Charsadda	31.38	1462.52	2.02	48.59
3	Sargodha	61.04	3524.65	4.86	57.75	3	Mardan	29.99	1288.00	1.77	42.88
4	Muzaffargarh	48.12	3441.37	4.75	71.52	4	Peshawar	10.70	555.51	0.77	51.84
5	Jhang	44.52	2701.65	3.73	60.68	5	Malakand	4.88	188.55	0.28	38.80
6	Rajapur	35.59	2528.95	3.63	73.87	6	Nowshera	2.98	152.05	0.21	51.08
7	Chiriot	37.46	2273.77	3.14	60.70	7	Swabi	2.41	83.70	0.13	38.81
8	T.T.Singh	32.26	2018.01	2.78	62.50	8	Tank	1.04	27.00	0.04	25.83
9	Bhakkar	26.80	1735.03	2.38	60.71	9	Bannu	0.50	22.50	0.03	44.88
10	Bahawalpur	20.87	1363.58	1.88	65.98	10	Khyber AG.	0.71	16.31	0.02	23.09
11	Kasur	24.07	1318.81	1.82	54.77	11	Mohmand AG.	0.18	8.18	0.01	32.89
12	M.B.Din	21.90	1200.14	1.68	54.79	12	Bunir	0.08	2.70	0.00	33.83
13	Layyah	16.53	1121.00	1.55	67.41	13	Kohat	0.08	2.12	0.00	34.81
14	D.G.Khan	9.88	762.30	1.04	76.11	14	Haripur	0.07	2.10	0.00	31.48
15	Yehari	12.32	737.26	1.02	58.84	15	Lalod Marwat	0.02	0.80	0.00	36.91
16	Bahawalnagar	10.87	670.13	0.82	61.08	16	F.R.D.I.Khan	0.10	0.72	0.00	7.38
17	Nankana Sahib	10.47	593.06	0.82	58.65	17	F.R.Peshawar	0.02	0.62	0.00	29.85
18	Okara	10.60	578.56	0.80	54.41	18	Hangu	0.01	0.52	0.00	35.23
19	Khushab	7.53	381.89	0.53	60.75	19	Dir Lower	0.01	0.46	0.00	31.36
20	Khanewal	6.21	374.92	0.52	60.39	20	F.R.Bannu	0.05	0.36	0.00	7.55
21	Hafizabad	5.88	332.13	0.48	58.50	21	Maricaha	0.01	0.19	0.00	24.13
22	Multan	5.29	292.40	0.40	55.27						
23	Lodhran	4.11	275.89	0.38	67.16						
24	Sahwal	3.32	190.76	0.26	57.51						
25	Mianwali	2.78	148.75	0.21	53.57						
26	Shekhupura	1.72	114.82	0.16	66.92						
27	Gujrat	2.11	98.71	0.14	46.79						
28	Pakpattan	1.45	82.40	0.11	58.76						
29	Gujranwala	1.84	81.89	0.11	44.51						
30	Narowal	1.32	47.74	0.07	36.20						
31	Sialkot	1.18	47.82	0.07	40.29						
32	Lahore	0.39	20.10	0.03	51.44						
33	Jhelum	0.28	9.74	0.01	37.84						
	Sub Total	737.71	47773.47	65.89	64.76		Sub Total	128.07	6256.27	8.63	50.01
SINDH						BALUCHISTAN					
1	Ghotki	68.78	4032.83	5.58	68.61	1	Sibi	0.62	34.19	0.05	54.97
2	Nawabshah	32.84	2241.59	3.08	68.88	2	Jaffarabad	0.16	8.48	0.01	53.01
3	Thatta	36.36	2221.63	3.08	61.10	3	Lasbela	0.03	1.66	0.00	61.72
4	N.Feroze	22.84	1428.37	1.87	64.60						
5	Kharipur	22.27	1334.44	1.84	59.82						
6	Badin	24.58	1157.18	1.60	47.12						
7	Tando Allahyar	20.18	1075.90	1.48	53.32						
8	Tando Muhammad	15.75	974.93	1.34	61.81						
9	Sanghar	14.54	889.57	1.24	61.88						
10	Matiari	13.44	873.70	1.20	65.03						
11	Mirpurkhas	15.85	868.01	1.20	54.41						
12	Sukkur	7.21	459.13	0.63	63.84						
13	Hyderabad	6.08	351.85	0.49	58.08						
14	Dadu	6.10	334.86	0.46	54.87						
15	Unerkot	1.70	71.87	0.10	42.45						
16	Larkana	0.71	47.41	0.07	66.40						
17	Jamshoro	0.48	22.39	0.03	47.08						
18	Shikarpur	0.32	13.68	0.02	44.08						
19	Tharparkar	0.23	12.87	0.02	55.81						
20	Jacobabad	0.14	5.82	0.01	40.88						
21	Shadadkot	0.10	5.59	0.01	54.84						
22	Kashmore	0.08	2.43	0.00	40.53						
	Sub Total	299.61	18435.98	25.43	61.53		Sub Total	0.81	44.33	0.06	54.80
							Pak Total	1163.20	72509.03	100.00	62.34

- Notes: 1 Data have been arranged in descending order of production.
2 Percentage shares are calculated on the basis of country total.
- Sources: 1- MINFAL, Islamabad
2- Respected Agriculture Provincial Departments

AVERAGE FARMER COST OF PRODUCTION OF SUGARCANE IN PUNJAB FOR 2019-20 AND 2020-21 CROPS

S.No	Operations /Inputs	Unit	Average No. of units/used acre	For 2019-20 crop		For 2020-21 crop		Change in 2019-20 over 2018-19
				Cost per unit	Cost per acre	Cost per unit	Cost per acre	
1	2	3	4	5	6=4*5	7	8=4*7	9=8-6
Rupees.....								
1	Land preparation:							
	1.1 Deep ploughing	No. of ploughings	0.580	1,500.0	870.0	1,600.0	928.0	58.0
	1.2 Rotary or disc plough used	No. of ploughings	1.000	1,600.0	1,600.0	1,700.0	1,700.0	100.0
	1.3 Ploughing	"	4.000	859.0	3,436.0	900.0	3,600.0	164.0
	1.4 Planking	No. of plankings	1.000	429.5	429.5	450.0	450.0	20.5
	1.5 Tractor levelling	Hour	0.540	859.0	463.9	900.0	486.0	22.1
	1.6 Laser levelling	Hour	1.000	1,264.0	1,264.0	1,275.0	1,275.0	11.0
2	Seed bed preparation:							
	2.1 Ploughing	No	1.000	859.0	859.0	900.0	900.0	41.0
	2.2 Ridge making with tractor	Hour	0.500	859.0	429.5	900.0	450.0	20.5
	2.3 Clearing soil at ends of ridges (labor charges)	M. day	1.000	500.0	500.0	600.0	600.0	100.0
3	Seed and sowing operations:							
	3.1 Seed used	Mt/ha/acre	10.000	1,000.0	10,000.0	1,050.0	10,500.0	500.0
	3.2 Contract sowing - including harvesting, stripping, making of sets for seed, transport and sowing	Rs./acre			4,000.0		4,500.0	500.0
4	Irrigation:	No. of irrigations/acre						
	4.1 Canal	"	9.000		250.0		250.0	-
	4.2 Private tubewell (RS/irrigation)	"	7.000	875.0	6,125.0	890.0	6,230.0	105.0
	4.3 Mixed	"	2.160	437.5	945.0	445.0	961.2	16.2
	4.4 Labour for irrigation and water course cleaning	M. days/acre	2.000	500.0	1,000.0	600.0	1,200.0	200.0
5	Interculture/hoeing:							
	5.1 Manual hoeing on contract	No. of hoeings	1.400	1,200.0	1,680.0	1,250.0	1,750.0	70.0
	5.2 With tractor	Hour/acre	0.500	859.0	429.5	900.0	450.0	20.5
6	Plant protection including application cost:							
	6.1 weedicide	No. of applications	1.000	1,000.0	1,000.0	1,100.0	1,100.0	100.0
	6.2 Sprays	"	1.000	872.0	872.0	900.0	900.0	28.0
	6.3 Application cost	Rs.Application/acre	3.000	200.0	600.0	225.0	675.0	75.0
7	Farm Yard Manure including transport and application cost	No. of trolleys	0.800	3,000.0	1,300.0	3,200.0	1,386.7	86.7
8	Fertilizers: (bags):	No. of bags						
	8.1 DAP	"	2.000	3,614.0	7,228.0	3,400.0	6,800.0	(428.0)
	8.2 Urea	"	3.600	1,830.0	6,588.0	1,650.0	5,940.0	(648.0)
	8.3 NP	"	0.520	2,939.0	1,529.3	2,550.0	1,326.0	(202.3)
	8.4 CAN	"	0.250		-	1,400.0	350.0	350.0
	8.5 SOP	"	0.700	4,000.0	2,800.0	4,100.0	2,870.0	70.0
	8.6 Fertilizer transport and application cost	"	7.070	100.0	707.0	85.0	601.0	(106.1)
9	Traded inputs' cost (Item 1 to 8 minus Item 4.1)	Rs./acre			56,904.6		58,178.8	1,274.2
10	Mark up on item 9 @ 13% per annum for 13 months	"			8,592.6		8,158.3	(434.3)
11	Land rent for 13 months	"		30,000.0	32,500.0	35,000.0	37,916.7	5,416.7
12	Average weighted land tax @ Rs 132/acre/annum for 13 months	"			132.0		132.0	
13	Management charges for 13 months	"	1.08		2,909.0		3,000.0	91.0
14	Crop harvesting, stripping, binding, loading etc	Rs./40 Kg		22.0	15,149.8	22.0	15,400.0	250.3
15	Total cost	Rs./acre			116,188.0		122,785.8	6,597.8
16	Yield per acre	40 Kg/acre			688.63		700.00	11.4
17	17.1 Cost of production at farm level with land rent	Rs./40 Kg			168.7		175.41	6.7
	17.2 Cost of production at farm level without land rent	Rs./40 Kg			121.5		121.24	(0.3)
18	Marketing cost	Rs./40 Kg			17.00		17.50	0.5
19	Road Cess	Rs./40 Kg			1.00		1.00	-
20	20.1 Cost of production at mill gate with land rent	Rs./40 Kg			186.72		193.91	7.2
	20.2 Cost of production at mill gate without land rent	Rs./40 Kg			139.53		139.74	0.2

Source:

- 1 For rates/prices of inputs, API field survey, 2020
- 2 Average yield in Punjab, as used by Crop Reporting Service in their cost of production for 2019-20.

**ESTIMATES FOR AVERAGE FARMER'S COST OF PRODUCTION OF SUGARCANE IN SINDH:
2019-20 AND 2020-21 CROP**

S. No	Operations / Inputs	Unit	Average No. of units/used acre	For 2019-20 crop		For 2020-21 crop		Change in 2020-21 over 2019-20
				Cost per unit	Cost per acre	Cost per unit	Cost per acre	
1	2	3	4	5	6=4*5	7	8=7*4	9=8-6
1	Land preparation:							
	1.1 Deep ploughing	No	0.680	1,600.0	1,088.0	1,800.0	1,224.0	136
	1.2 Ploughing	No	4.000	1,200.0	4,800.0	1,250.0	5,000.0	200
	1.3 Planking	No	1.000	600.0	600.0	625.0	625.0	25
	1.4 Tractor levelling	Hour	0.30	1,200.0	360.0	1,250.0	375.0	15
	1.5 Laser levelling	"	1.000	1,250.0	1,250.0	1,300.0	1,300.0	50
2	Seed bed preparation							
	2.1 Ploughing	No	1.000	1,200.0	1,200.0	1,250.0	1,250.0	50
	2.2 Ridge making with tractor	Hrs.	0.500	1,200.0	600.0	1,300.0	650.0	50
	2.3 Clearing soil at ends of ridges	M. day	1.000	500.0	500.0	600.0	600.0	100
3	Seed and sowing operations:							
	3.1 Seed used	40 Kgs	89.0	182.0	16,198.0	185.0	16,465.0	267
	3.2 Contract sowing including harvesting, stripping, making of sets, transport and sowing	Rs./acre			3,600.0		3,700.0	100
4	Irrigation							
	4.1 Canal	Irrigations/acre	18		250.0		250.0	0
	4.2 Private tubewell (RS./irrigation)	Irrigations/acre	1.0	750.0	750.0	775.0	775.0	25
	4.3 Mixed	"	2.16	750.0	1,620.0	775.0	1,674.0	54
	4.4 Labour for irrigation and water course cleaning	M. day	2.0	500.0	1,000.0	600.0	1,200.0	200
5	Interculture/ hoeing							
	5.1 Manual		2.000	2,000.0	4,000.0	2,100.0	4,200.0	200
	5.2 Hoeing with tractor	No	1.800	1,200.0	2,160.0	1,300.0	2,340.0	180
6	Plant protection including application cost							
	6.1 Weedicide	No. of sprays	1.000	900.0	900.0	950.0	950.0	50
	6.2 Granules	"	1.20	800.0	960.0	850.0	1,020.0	60
	6.4 Application cost	Rs./appl./acre	2.20	150.0	330.0	175.0	385.0	55
7	Farm Yard Manure including transport & application cost (50%)	No. of trolleys	0.32	1,800.0	576.0	2,000.0	640.0	64
8	Fertilizers: (bags)							
	8.1 DAP	No. of bags	1.600	3,700.0	5,920.0	3,500.0	5,600.0	-320
	8.2 Urea	"	4.000	1,850.0	7,400.0	1,850.0	7,400.0	0
	8.3 NP	"	0.560	2,950.0	1,652.0	2,800.0	1,568.0	-84
	8.4 CAN	"						0
	8.5 SOP	"	0.200	3,900.0	780.0	4,500.0	900.0	120
	8.6 Fertilizer transport and application cost	"	6.360	100.0	636.0	100.0	636.0	0
9	Traded inputs cost (item 1 to 8-Item 4.1)	Rs./acre			58,880.0		60,477.0	1597
10	Mark up on item 9 @ 13% per annum for 13 month	"			8,930.1		8,517.2	-413
11	Land rent	"		26,000.0	28,166.7	30,000.0	32,500.0	4333
12	Average weighted land tax @ Rs 200/acre/annum for 13 month	"			132.0		132.0	0
13	Management charges for 13 months	"			2,909.0		3,000.0	91
14	Crop harvesting, stripping, binding, loading, etc	Rs/ 40 Kg		17.0	10,705.8	17.0	11,220.0	514
15	Total cost	Rs./ acre			109,973.6		116,096.18	6123
16	Yield per acre	40 Kg/ acre			629.75		660.00	30
17	Cost of production at farm level							
	17.1 Including land rent	Rs/ 40 Kg			174.6		175.9	1.3
	17.2 Excluding land rent	Rs/ 40 Kg			129.9		126.7	-3.2
18	Marketing cost							
	18.1 Transport	Rs./40 Kg			17.0		17.5	0.5
	18.2 Road Cess	Rs./40 Kg			1.0		1.0	0.0
19	Cost of production at mill gate							
	19.1 Including land rent	Rs/ 40 Kg			192.6		194.40	1.8
	19.2 Excluding land rent	Rs/ 40 Kg			147.9		145.16	-2.7

Sources:

- 1 For input usage, API field survey, 2020
- 2 For input rates, field surveys of API for respective years.
- 3 For yield, Crop reporting Service, Sindh

**ECONOMICS OF SUGARCANE AND COMPETING CROPS AT
PRICES REALIZED BY THE GROWERS: 2019-20 CROPS**

S #	Province/crops/crop combination	Crop duration	Water used	Gross cost	Cost of purchased inputs	Gross revenue	Gross margin	Net income	Output-input ratio	Revenue per		
		Days	Acre inchesRupees per acre.....					Ratio	Rupee of purchased inputs	Crop day	Acre Inch of water used
		1	2	3	4	5	6	7=6-5	8=6-4	9=6/4	10=6/5	11=6/2
Punjab												
1	Sugarcane	394	48	116197	39651	139103	99452	22906	1.20	3.51	353	2898
2	Seed Cotton	240	22	73136	24409	83089	58680	9953	1.14	3.40	346	3777
3	Basmati Paddy	180	58	62874	31003	70743	39740	7868	1.13	2.28	393	1220
4	IRRI Paddy	180	62	64826	29022	67198	38175	2371	1.04	2.32	373	1084
5	Wheat	180	12	48303	14558	50919	36361	2616	1.05	3.50	283	4243
6	Sunflower (spring)	180	22	51601	18548	55538	36989	3937	1.08	2.99	309	2524
7	Seed Cotton + Wheat	420	34	121439	38968	134008	95040	12569	1.10	3.44	319	3941
8	Seed Cotton+Sunflower	420	44	124737	42957	138627	95669	13889	1.11	3.23	330	3151
9	Basmati Paddy+Wheat	360	70	111178	45561	121662	76100	10484	1.09	2.67	338	1738
10	Basmati Paddy+Sunflower	360	80	114475	49551	126280	76729	11805	1.10	2.55	351	1579
11	IRRI Paddy + Wheat	360	74	113129	43581	118117	74536	4987	1.04	2.71	328	1596
12	IRRI Paddy+Sunflower	360	84	116427	47571	122735	75164	6308	1.05	2.58	341	1461
Sindh												
1	Sugarcane	488	71	109973	37066	127210	90144	17236	1.16	3.43	261	1792
2	Seed Cotton	240	18	80876	27403	90757	63354	9881	1.12	3.31	378	5042
3	IRRI Paddy	180	56	53211	18745	59950	41205	6739	1.13	3.20	333	1071
4	Wheat	180	12	49199	15595	53184	37589	3985	1.08	3.41	295	4432
5	Sunflower (spring)	180	22	38783	14018	38824	24806	41	1.00	2.77	216	1765
6	Seed Cotton + Wheat	420	30	130075	42998	143941	100943	13866	1.11	3.35	343	4798
7	Seed Cotton+Sunflower	420	40	119659	42998	129581	86583	9922	1.08	3.01	309	3240
8	IRRI Paddy+ Wheat	360	68	102410	34340	113134	78794	10724	1.10	3.29	314	1664
9	IRRI Paddy+Sunflower	360	78	91994	32762	98774	66011	6779	1.07	3.01	274	1266

Notes for Annex - :

1. The economic analysis presented in the above exercise is based on the input-output prices applicable for 2019-20 crops.
2. The data regarding input-output parameters have been adopted from the API's price policy papers for sugarcane, seed cotton, rice paddy and wheat, 2019-20 crops. However, the relevant data for sunflower and canola were adopted from the last support price policy for non-traditional oilseeds 2000-01 crops, with necessary adjustments in input prices for updating costs and incomes for the 2019-20 crops. To incorporate the escalations in input prices, which occurred during the growing period of 2019-20 crops, some marginal revisions/updates have been incorporated.
3. Water use has been estimated from the number of irrigations as reported in the cost of production estimates of the respective crops assuming each irrigation of 3 inches and 'rauni' of 4 inches.
4. The following prices as realized by the growers for different crops are adopted for the analysis:
 - 4.1 The support price of Rs 1400 per 40 kgs, as maintained by the government for 2019-20 crop, has been adopted for the current analysis.
 - 4.2 The wholesale market prices of basmati paddy and IRRI paddy during the post-harvest period in major producer area markets have averaged at Rs 1950 and Rs 1350 per 40 kgs, respectively. While, the average price of IRRI paddy in Sindh is reported at Rs 1300 per 40 kgs.
 - 4.3 The wholesale market prices of seed cotton during the post-harvest months of 2019-20 in the main producer area markets have averaged at Rs 3949 per 40 kgs in the Punjab and Rs 3634 Sindh.
 - 4.4 The price of Sunflower crops has been reported hovering around Rs 3000/40 kgs and Rs 3050/40 kgs for Canola during 2019-20.
 - 4.5 The average market prices of sugarcane as realized by the farmers are taken for the analysis i.e Rs 220 per 40 kgs in the Punjab and in Sindh. However, the prices notified by the provincial governments were lower i.e Rs 190 and 192, respectively for Punjab and Sindh.
5. The market prices have been adjusted for the marketing expenses to make them effective at the farm level. These expenses amount to Rs 18 per 40 kgs in Punjab and Sindh for sugarcane, Rs 40 for seed cotton in Punjab and Sindh, Rs 50 for rice paddy in Punjab and Sindh, and for wheat and oilseeds, Rs 38 in Punjab and Rs 42 in Sindh.

6. Gross income = (Yield per acre multiplied by price of principal produce at farm gate) plus (value of by-products per acre).
7. Cost of purchased inputs = Cost incurred on seed and related items, fertilizer, supplementary irrigation including labour, canal water rate, pesticides and weedicides.
8. Gross margin = Gross income minus cost of purchased inputs.
9. Net income = Gross income minus gross cost.
10. Output-input ratio = Gross income divided by gross cost
11. Revenue per rupee of purchased inputs cost = Gross income divided by cost of purchased inputs
12. Revenue per crop day = Gross income divided by crop duration in days.
13. Revenue per acre-inch of water used = Gross income divided by irrigation water used in acre inches.

ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN PUNJAB (AVERAGE FARMER)

Item	Under sugar importing scenario											
	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19	
	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices
A GROSS INCOME												
1. Yield(40 kgs/acre)	565	565	585	585	565	565	600	600	600	600	660	660
2. Price(Rs/40 kgs)	170	133	180	122	180	133	180	132	180	139	180	173
NPC		1.28		1.48		1.35		1.36		1.29		1.04
3. Income from cane	96076	75346	105300	71130	101727	75120	108000	79206	108000	83586	118710	114417
4. Value of tops												
5. Gross Income	96076	75346	105300	71130	101727	75120	108000	79206	108000	83586	118710	114417
B GROSS COSTS												
I Traded Inputs												
i. Seed	5679	5679	5679	5679	5679	5679	6384	6384	5320	5320	10000	10000
ii. Fertilizer	9190	7628	9027	7493	9331	7745	6836	5674	6877	8627	18546	20296
iii. Plant protection	275	231	298	283	329	313	306	291	316	300	1650	1568
iv. Machinery:												
Tractor operations	7859	6602	8458	7020	8458	7020	8388	6962	7816	6487	8719	7237
Tubewell	5620	3777	5778	3883	5778	3883	3467	2330	3065	2060	6060	4072
v. Escalation in traded inputs' cost	4761	4761	3578	3578	2640	2640	2609	2609	2975	2975	0	0
Sub-total	33384	28677	32818	27936	32215	27280	27909	24249	26369	25769	44975	43173
II. Domestic Factors												
1 Hired Labour:												
1.1 Pre-Harvest	7363	7363	8248	8248	8402	8402	12374	12374	10523	10523	8447	8447
1.2 Harvesting, shipping, binding, loading	7272	7272	7272	7272	7273	7273	8316	8316	8316	8316	13190	13190
2. Working Capital (Mark-up)	4818	0	6279	0	6383	0	6436	0	4645	0	8194	0
3. Farm yard manure	1075	1075	1150	1150	1300	1300	1850	1850	1813	1813	607	607
5. Canal water	250	1000	250	1000	250	1000	250	1000	252	1008	250	1000
6. Management charges	2103	2103	2235	2235	2362	2362	2540	2540	2909	2909	2909	2909
7. Land Rent (For 13 months)	22750	22750	24917	24917	26000	26000	26000	26000	26000	26000	27083	27083
8. Land Tax	143	143	143	143	143	143	144	144	143	143	132	132
9. Land revenue												
Total Domestic Cost (II.1- II.9)	45773	27071	50493	29445	52113	30805	57909	31534	54348	31873	60812	31731
Gross cost	79158		83311		84328		85809		80717		105787	
Input parity (mill gate) price of sugarcane	148.32		136.59		147.92		147.01		154.31		188.49	
Transport charges from farm to mill gate (Rs./40Kg)	14		14.00		14		14.00		14.00		14.00	
Development charges (Rs./40Kg)	1		1.00		1		1.00		1.00		1.00	
Price of sugarcane at farm level	133		121.59		133		132.01		139.31		173.49	

Source: Cost of production of sugarcane, 2019-20

ANNEX-VIII

**GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTOR
COST IN PUNJAB ESTIMATED ON THE BASIS OF PRIVATE AND SOCIAL
(BASIS - IMPORT PARITY PRICE OF SUGARCANE)**

Description	Revenue	Traded Inputs Cost	Domestic Factor Cost	Profit
----- Rupees peracre -----				
2013-14				
Private Prices	96076	33384	45773	16918
Social Prices	75346	28677	27071	19598
Transfers	20730	4707	18702	-2680
2014-15				
Private Prices	105300	32818	50493	21989
Social Prices	71130	27936	29445	13750
Transfers	34170	4883	21048	8239
2015-16				
Private Prices	101727	32215	52113	17399
Social Prices	75120	27280	30805	17035
Transfers	26607	4936	21308	364
2016-17				
Private Prices	108000	27990	57909	22101
Social Prices	79206	24249	31534	23423
Transfers	28794	3741	26375	-1322
2017-18				
Private Prices	108000	26369	54348	27283
Social Prices	83586	25769	31873	25945
Transfers	24414	600	22476	1338
2018-19				
Private Prices	118710	44975	60812	12923
Social Prices	114417	43173	31731	39513
Transfers	4293	1802	29081	-26590

Source: Annex-VII

ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN PUNJAB (AVERAGE FARMERS)

Under sugar EXPORTING scenario

Item	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19	
	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices
A. GROSS INCOME												
1. Yield(40 kgs/acre)	565	565	585	585	565	565	600	600	600	600	660	660
2. Price(Rs/40 kgs)	170	96	180	84	180	96	180	96	180	104	180	148
NPC		1.77		2.15		1.88		1.88		1.73		1.21
3. Income from cane	96076	54322	105300	49052	101727	53977	108000	57492	108000	62388	118710	97771
4. Value of tops												
5. Gross Income	96076	54322	105300	49052	101727	53977	108000	57492	108000	62388	118710	97771
B. GROSS COSTS												
I. Traded Inputs												
i. Seed	5679	5679	5679	5679	5679	5679	6384	6384	5320	5320	10000	10000
ii. Fertilizer	9190	7628	9027	7493	9331	7745	6836	5674	6877	8627	18546	20296
iii. Plant protection	275	231	298	283	329	313	306	291	316	300	1650	1568
iv. Machinery:												
Tractor operations	7859	6602	8458	7020	8458	7020	8388	6962	7816	6487	8719	7237
Tubewell	5620	3777	5778	3883	5778	3883	3467	2330	3065	2060	6060	4072
v. Escalation in traded inputs' cost	4761	4761	3578	3578	2640	2640	2609	2609	2975	2975	0	0
Sub-total	33384	28677	32818	27936	32215	27280	27990	24249	26369	25769	44975	43173
II. Domestic Factors												
1. Hired Labour												
1.1 Pre -Harvest	7363	7363	8248	8248	8402	8402	12374	12374	10523	10523	8447	8447
1.2 Harvesting, stripping, binding, loading	7272	7272	7272	7272	7273	7273	8316	8316	8316	8316	13190	13190
2. Working Capital (Mark-up)	4818	0	6279	0	6383	0	6436	0	4645	0	8194	0
3. Farm yard manure	1075	1075	1150	1150	1300	1300	1850	1850	1813	1813	607	607
4. Transportation												
5. Canal water	250	1000	250	1000	250	1000	250	1000	252	1008	250	1000
6. Management charges	2103	2103	2235	2235	2362	2362	2540	2540	2909	2909	2909	2909
7. Land Rent (For 13 months)	22750	22750	24917	24917	26000	26000	26000	26000	26000	26000	27083	27083
8. Land Tax	143	143	143	143	143	143	144	144	143	143	132	132
9. Land revenue												
Total Domestic Cost (II.1..II.8)	45773	27071	50493	29445	52113	30805	57909	31534	54348	31873	60812	31731
Gross cost	79158		83311		84328		85899		80717		105787	
Export parity (mill gate price) of sugarcane	111.12		98.85		110.51		110.82		118.98		163.25	
Transport charges from farm to mill gate (Rs./ 4t	14		14.00		14		14.00		14.00		14.00	
Development charges (Rs./ 40 Kg)	1		1.00		1		1.00		1.00		1.00	
Price of sugarcane at farm level	96		83.85		96		95.82		103.98		148.25	

Source: Cost of production of sugarcane, 2019-20

ANNEX- X

**GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTOR
COST IN PUNJAB ESTIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES
(BASIS - EXPORT PARITY PRICE)**

Description	Revenue	Traded Inputs Cost	Domestic Factor Cost	Profit
————— Rupees per acre —————				
2013-14				
Private Prices	96076	33384	45773	16918
Social Prices	54322	28677	27071	-1426
Transfers	41753	4707	18702	18344
2014-15				
Private Prices	105300	32818	50493	21989
Social Prices	49052	27936	29445	-8328
Transfers	56248	4883	21048	30317
2015-16				
Private Prices	101727	32215	52113	17399
Social Prices	53977	27280	30805	-4107
Transfers	47750	4936	21308	21506
2016-17				
Private Prices	108000	27990	57909	22101
Social Prices	57492	24249	31534	1709
Transfers	50508	3741	26375	20392
2017-18				
Private Prices	108000	26369	54348	27283
Social Prices	62388	25769	31873	4747
Transfers	45612	600	22476	22536
2018-19				
Private Prices	118710	44975	60812	12923
Social Prices	97771	43173	31731	22867
Transfers	20939	1802	29081	-9944

Source: Annex-IX

ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN SINDH (AVERAGE FARMERS)

Based on Import parity prices

Item	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19	
	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices
A. GROSS INCOME												
1. Yield(40 kgs/acre)	676	676	676	676	676	676	676	676	676	676	700	700
2. Price(Rs/40 kgs)	172	139	182	113	172	123	182	146	181	145	182	183
NPC		1.24		1.61		1.40		1.24		1.24		1.00
3. Income from sugarcane	116272	93788	123032	76462	116272	83094	123032	98851	122356	98338	127400	127967
4. Value of tops	8788	8788	8788	8788	8788	8788	9800	9800	12000	12000	11900	11900
5. Gross Income	125060	102577	131820	85251	125060	91882	132832	108651	134356	110338	139300	139867
B. GROSS COSTS												
I. Traded Inputs												
i. Seed	10769	9046	10769	8938	10769	9046	10769	8938	11256	9342	16198	13444
ii. Fertilizer	13262	11140	13419	11138	14015	11773	10469	8689	10346	8587	15514	12877
iii. Plant protection	353	297	403	383	440	369	452	430	510	485	1716	1630
iv. Machinery:												
Tractor	10032	8427	11013	9141	11013	9251	8009	6647	10284	8536	10127	8405
Tubewell	1678	1410	1838	1525	1838	1544	1715	1423	858	712	2291	1902
v. Escalation in traded inputs' cost	5074	5074	3552	3552	2668	2668	2668	2668	2668	2668	0	0
Sub-total	41169	35394	40995	34678	40743	34651	34082	28796	35922	30330	45846	38258
II. Domestic Factors												
1. Hired Labour												
1.1 Pre-Harvest	9882	9882	11273	11273	11377	11377	11577	11577	12429	12429	11509	11509
1.2 Harvesting & threshing	8788	8788	8788	8788	8788	8788	9800	9800	12000	12000	11900	11900
2. Working Capital (Mark-up)	7568	6369	10023	6654	10190	6779	8898	6176	7412	6772	8776	8017
3. Farm yard manure	1325	1325	1400	1400	1500	1500	1500	1500	1500	1500	256	256
4. Transportation												
5. Canal water	182	727	182	727	182	727	182	727	182	727	250	1000
6. Management charges	2589	2589	2589	2589	2907	2907	2907	2907	2909	2909	2909	2909
7. Land Rent (For 16 months)	21333	21333	24000	24000	25333	25333	26667	26667	27083	27083	28167	28167
8. Land Tax	267	267	267	267	267	267	267	267	267	267	132	132
9. Drainage Cess	24		24		24		24					
Total Domestic Cost (II.1-II.9)	51959	51281	58546	35638	60568	57679	61822	59621	63783	63688	63899	63890
Gross cost	93128		99541		101311		95904		99522		109495	
Import parity price of sugarcane	152.99		127.36		137.92		161.23		160.47		197.81	186.12
transport charges from farm to mill gate	14		14		14		14.00		14.00		14.00	
road cess	0		0.25		1		1.00		1.00		1.00	
farm level price	139		113		123		146		145		183	

Source: Estimated from cost of production data.

ANNEX-XII

**GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTOR
COST IN SINDH ESTIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES
(BASIS - IMPORT PARITY PRICE OF SUGAR)**

Description	Revenues	Traded Cost	Domestic Factors' Cost	Profits
2013-14	-----Rs per acre-----			
Private Prices	125060	41169	51959	31932
Social Prices	102577	35394	51281	15902
Transfers	22484	5775	678	16031
2014-15				
Private Prices	131820	40995	58546	32280
Social Prices	85251	34678	35638	14935
Transfers	46570	6317	22908	17344
2015-16				
Private Prices	125060	40743	60568	23749
Social Prices	91882	34651	57679	-448
Transfers	33178	6092	2890	24197
2016-17				
Private Prices	132832	34082	61822	36928
Social Prices	108651	28796	59621	20234
Transfers	24181	5286	2201	16693
2017-18				
Private Prices	134356	35922	63783	34652
Social Prices	110338	30330	63688	16320
Transfers	24018	5592	95	18332
2018-19				
Private Prices	139300	45846	63899	29555
Social Prices	139867	38258	63890	37719
Transfers	-567	7588	9	-8164

Source: Annex- XI

ECONOMIC EFFICIENCY OF RESOURCE USE IN SUGARCANE IN SINDH (AVERAGE FARMERS)

Based on Export parity prices

Item	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19	
	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices	Private Prices	Social Prices
A. GROSS INCOME												
1. Yield(40 kgs/acre)	676	676	676	676	676	676	676	676	676	676	700	700
2. Price(Rs/40 kgs)	172	101	182	78	172	88	182	110	181	109	182	86
NPC		1.7		2.3		2.0		1.7		1.7		2.1
3. Income from sugarcane	116272	67979	123032	52667	116272	59508	123032	74502	122356	73501	127400	60347
4. Value of tops	8788	8788	8788	8788	8788	8788	9800	9800	12000	12000	11900	11900
5. Gross Income	125060	76767	131820	61455	125060	68296	132832	84302	134356	85501	139300	72247
B. GROSS COSTS												
I. Traded Inputs												
i. Seed	10769	9046	10769	8938	10769	9046	10769	8938	11256	9342	16198	13444
ii. Fertilizer	13262	11140	13419	11138	14015	11773	10469	8689	10346	8587	15514	12877
iii. Plant protection	353	297	403	383	440	369	452	430	510	485	1716	1630
iv. Machinery:												
Tractor	10032	8427	11013	9141	11013	9251	8009	6647	10284	8536	10127	8405
Tubewell	1678	1410	1838	1525	1838	1544	1715	1423	858	712	2291	1902
v. Escalation in trade	5074	5074	3552	3552	2668	2668	2668	2668	2668	2668	0	0
Sub-total	41169	35394	40995	34678	40743	34651	34082	28796	35922	30330	45846	38258
II. Domestic Factors												
1. Hired Labour												
1.1 Pre-Harvest	9882	9882	11273	11273	11377	11377	11577	11577	12429	12429	11509	11509
1.2 Harvesting &	8788	8788	8788	8788	8788	8788	9800	9800	12000	12000	11900	11900
2. Working Capital (M)	7568	6369	10023	6654	10190	6779	8898	6176	7412	6772	8776	8017
3. Farm yard manure	1325	1325	1400	1400	1500	1500	1500	1500	1500	1500	256	256
4. Transportation												
5. Canal water	182	727	182	727	182	727	182	727	182	727	250	1000
6. Management charge	2589	2589	2589	2589	2907	2907	2907	2907	2909	2909	2909	2909
7. Land Rent (For 16)	21333	21333	24000	24000	25333	25333	26667	26667	27083	27083	28167	28167
8. Land Tax	267	267	267	267	267	267	267	267	267	267	132	132
9. Drainage Cess	24		24		24		24					
Total Domestic Cost (II.1..I)	51959	51281	58546	35638	60568	57679	61822	59621	63783	63688	63899	63890
Gross cost	93128		99541		101311		95904		99522		109495	
Export parity price of sugarcane	114.81		92.16		103.03		125.21		123.73		101.21	186.12
transport charges from farm	14		14		14		14.00		14.00		14.00	
road cess	0		0.25		1		1.00		1.00		1.00	
farm level price	101		78		88		110		109		86	

Source: Annex-V

ANNEX-XIV

GROSS REVENUE OF SUGARCANE, TRADED INPUTS AND DOMESTIC FACTOR
COST IN SINDH ESTIMATED ON THE BASIS OF PRIVATE AND SOCIAL PRICES
(BASIS - EXPORT PARITY PRICE OF SUGAR)

Description	Revenues	Traded Cost	Domestic Factors' Cost	Profits
-----Rs per acre-----				
2013-14				
Private Prices	125060	41169	51959	31932
Social Prices	76767	35394	51281	-9908
Transfers	48293	5775	678	41840
2014-15				
Private Prices	131820	40995	58546	32280
Social Prices	61455	34678	35638	-8860
Transfers	70365	6317	22908	41140
2015-16				
Private Prices	125060	40743	60568	23749
Social Prices	68296	34651	57679	-24033
Transfers	56764	6092	2890	47782
2016-17				
Private Prices	132832	34082	61822	36928
Social Prices	84302	28796	59621	-4115
Transfers	48530	5286	2201	41043
2017-18				
Private Prices	134356	35922	63783	34652
Social Prices	85501	30330	63688	-8516
Transfers	48855	5592	95	43168
2018-19				
Private Prices	139300	45846	63899	29555
Social Prices	72247	38258	63890	-29901
Transfers	67053	7588	9	59456

Source- XIII

Notes for Economic Efficiency Analysis

Conceptual description		
	Private price is price of an input or output (crop) prevailing in the domestic open market	Social price is domestic price of an input or output (crop) estimated on the basis of import or export parity price
	Conceptual description at private price	Conceptual description at social price
1	Gross income	Price weighted production of sugarcane crop from an acre of land
		Domestic price of an input or a crop estimated on the basis of its import or export parity price (as the case may be)
2	Fertilizer expenditure	Cost of fertilizer applied to one acre of the crop
		Cost of fertilizer applied to one acre of the crop estimated at social price <i>less GST paid on this purchase @17%</i>
3	Plant protection expenditure	Cost of weedicides, granules and insecticides applied to the crop
		Cost of weedicides, granules and insecticides applied to the crop <i>less GST paid on these purchases @17%</i>
4	Cost of tractor operations	85% of the expenditure incurred in using tractor (for deep ploughing, planking, rotavator use, tractor/ laser levelling, ridge making, bund making and hoeing) 15% of tractor expenditure assumed salary of driver and included in pre-harvest labour
		85% of the expenditure incurred in using tractor (for deep ploughing, planking, rotavator use, tractor/ laser levelling, ridge making, bund making and hoeing) <i>less 17% GST levied on diesel</i>
5	Cost of tube well water	90% of the cost of tube water applied to the crop purchased at the market price. Remaining 10% assumed salary of tube well operator which is included in the Pre-harvest labour charges
		Respective cost at private prices <i>less 17% GST levied on diesel</i>
6	Traded inputs expenditure	Cost of seed, fertilizers, pesticides, tube well water, tractor operations and escalation in this expenditure
		Sum total of corresponding expenditures at social prices (as mentioned above)

Conceptual definition			
		<u>Conceptual description at private prices</u>	<u>Conceptual description at social prices</u>
7	Domestic factors' cost	Domestic factors' cost comprises cost of labour involved in <u>pre and post harvest operations</u> . It needs to be mentioned here that Post harvest labour costs also include cost of harvesting. Then sub total of proxy mark-up on capital, cost of Farm Yard Manure, transportation cost, canal water charges (abiana), management charges, land rent and land tax is added to pre and post harvest labour charges. This all makes 'Domestic Factors' Cost'.	Total cost of 'domestic factors' estimated at social prices
8	Labour involved in pre-harvest operations		
9	Cost of labour involved in tractor run operations	15% of cost of tractor run operations i.e deep ploughing, rotavator use, ploughing & planking, tractor/ laser levelling, ridge making and interculture	Same as described in 'Private Prices' column
10	Bund making (manual)	Cost of labour used for making bunds on daily wage basis	Same as described in 'Private Prices' column
11	Bund making with tractor	15% of the cost of making bunds with tractor (salary of driver)	Same as described under Private Prices column
12	Harvesting, stripping and making of sets for seed of sugarcane	Cost paid to labour for harvesting, peeling (stripping) and making sets of cane to sow as seed	Same as described under private prices column
13	Cost of labour for shifting seed (sets) of sugarcane	Cost paid to labour for transporting/ shifting sugarcane sets to the field prepared for sowing sugarcane	Same as described under private prices column
14	Sowing of sugarcane sets	Cost of labour employed on daily basis for sowing sugarcane.	Same as described under private prices column

Conceptual definition			
		<u>Conceptual description at private prices</u>	<u>Conceptual description at social prices</u>
15	Cost of contractual labour employed for	Cost of labour employed on contract for sowing sugarcane	Same as described under private prices column
16	Salary of tube well operator	10% of the cost of tube well water purchased and applied to sugarcane	Same as described under private prices column
17	Cost of labour used for irrigation and water	Cost of labour employed to irrigate sugarcane and clean water channels within the field	Same as described under private prices column
18	Manual hoeing	Wages paid to labour for hoeing	Same as under private prices column
19	Labor cost of post harvest operations (harvesting, striping,	Respective cost of labour paid at the prevailing wage rate	Same as described under private prices column
20	Working capital	Amount of interest @ 14.5% for 13 months (crop duration)	Same as described under private prices column
21	Cost of Farm Yard Manure	50% of the cost of farm yard manure Assumption: Existing crop consumes 50% of the cost of farm yard manure applied to the crop	Same as described under private prices column
22	Canal water	Rs 252/acre/annum (Abiana fixed by the Government)	Ra 1000 (4 times of Abiana) because canal water is subsidised in
22	Management charges	Equivalent to the pay of Field Assistant	Same as described under the Private Prices column
23	Land rent	Land rent for 13 months @ Rs. 24000/acre/annum Assumption: sugarcane occupies land for 13 months	Same as described in Private prices column
24	Land tax	Land tax @ Rs 143/annum/acre of sugarcane	Same as described in Private prices column

ANNEX - XV

**PER CAPITA AVAILABILITY (CONSUMPTION OF SUGAR: 2016-17 TO 2018-19
(October - September)**

S. No	Items	2016-17	2017-18	2018-19
		-----Thousands tonnes-----		
1	Opoening stocks as on 1st October	1866	1580	1495
2	Production	7005	6621	5267
3	Imports	9	8	7
4	Export	306	1572	619
5	Closing stocks as on 30th September	1886	1495	2060
6	Net availability (item 1+2+3-4-5)	6688	5142	4090
		-----Million-----		
7	Population (a)	209.85	214.09	218.31
		-----Kgs per annum-----		
8	Per capita availability (consumption)	31.87	24.02	18.73
9	Average per capita availability Average (2016-17 to 2019-20)		24.87	

Note: a). It includes the population of Pakistan, AJ&K, GB and Afghan Refugees.

Sources:

- | | |
|--------------------------------|--|
| 1. For stocks and production: | Pakistan Sugar Mills Association, Islamabad. |
| 2. For import and export: | Federal Bureau of Statistics, Karachi. |
| 3. For population of Pakistan: | Economic Survey, 2019-20. |

ANNEX- XVI

**DOMESTIC AVERAGE WHOLESALE PRICES OF SUGAR IN MAJOR
DOMESTIC MARKETS: 2019 AND 2020**

Month	Lahore	Fasilabad	Karachi	Hyderabad	Peshawar	Average
2019						
	----- Rupees per 100 kgs-----					
January	4750	5429	5600	5500	5700	5396
February	4750	5459	5500	5400	5640	5350
March	4750	5558	5600	5460	6120	5498
April	5750	5985	6300	6140	6500	6135
May	5934	6410	6400	6300	6600	6329
June	6975	6538	6600	6480	6700	6659
July	7200	6489	6800	6650	7100	6848
August	7242	7107	7000	6940	6960	7050
September	7400	7300	6800	6800	7120	7084
October	7157	7300	6700	6800	7020	6995
November	7200	7073	6650	6590	6940	6891
December	7017	6950	6750	6600	7120	6887
Average	6344	6466	6392	6305	6627	6427
2020						
January	7396	7111	7280	7060	7240	7217
February	7693	7502	7520	7350	7460	7505
March	7400	7629	7780	7690	7720	7644
April	7603	7650	7700	7560	7600	7623
May	7900	7650	7920	7740	7750	7792
June	7871	7650	7750	7420	7750	7688
Average	7644	7532	7658	7470	7587	7578

Sources: 1. Agriculture Marketing Information Services, Punjab, Lahore.
2. Bureau of Supply and Prices, Sindh, Karachi.
3. Agriculture Marketing Services, Peshawar, KPK.

**AVERAGE WHOLESALE PRICES OF SUGAR IN MAJOR DOMESTIC MARKETS:
2007-08 TO 2019-20 (October- September)**

Year	Lahore	Fasilabad	Karachi	Hyderabad	Peshawar	Average	Increase(+) decrease(-) in average price over
	----- Rupees per 100 kgs-----						Percent
2007-08	2444	2410	2390	2346	2473	2413	-
2008-09	4049	3997	3998	3938	4090	4014	66.39
2009-10	6203	6161	6138	6084	6276	6173	53.76
2010-11	6848	6706	6687	6895	6993	6826	10.58
2011-12	5326	5256	5055	5374	5350	5272	-22.75
2012-13	5117	5084	4977	4947	4772	4979	-5.56
2013-14	4942	4949	5050	5314	5113	5074	1.89
2014-15	5726	5634	5463	5529	5564	5619	10.75
2015-16	6198	6098	5975	5933	6750	6135	9.19
2016-17	6032	5889	6044	6006	6419	6118	-0.28
2017-18	4977	5008	5008	4931	4874	4960	-18.94
2018-19	5600	5883	5934	5835	6127	5876	18.47
2019-20 (Oct-Jun)	7471	7391	7339	7201	7400	7360	25.26

Sources: 1. Agriculture Marketing Information Services, Punjab, Lahore.
2. Agriculture Marketing Services, Sindh, Hyderabad.
3. Agriculture Marketing Services, Peshawar, KPK.

AVERAGE INTERNATIONAL PRICES OF SUGAR: 2009-10 to 2019-20 (OCT-SEP)

Years	ISA Daily price of Raw sugar (Fob and stowed Caribbean ports in bulk)		London Daily price of White sugar (Fob and stowed European ports in bags of 50 kgs)		Difference between White and raw sugar prices		
	US Cents/ lb	US\$/ tonne	US Cents/ lb	US\$/ tonne	US Cents/ lb	US\$/ tonne	Per cent of White Sugar
2009-10	20.41	450.03	26.07	574.68	4.86	107.23	17.66
2010-11	26.56	585.45	32.29	711.93	5.74	126.49	17.77
2011-12	22.68	499.96	27.54	607.20	4.86	107.23	17.66
2012-13	18.12	399.56	23.96	528.15	5.83	128.58	24.35
2013-14	17.42	384.02	20.96	461.99	3.54	77.97	16.88
2014-15	13.96	307.69	17.19	378.98	3.23	71.29	18.81
2015-16	16.56	370.19	20.89	460.45	3.23	71.29	18.81
2016-17	17.07	376.40	20.76	464.16	3.68	87.75	17.75
2017-18	12.96	285.62	15.84	349.12	2.88	63.50	18.19
2018-19	12.72	280.46	15.32	337.84	2.60	57.37	16.98
2019-20	12.47	274.89	16.25	358.34	3.79	83.45	23.29
Oct	12.57	277.12	15.38	339.13	2.81	62.01	18.29
Nov	12.78	281.75	15.37	338.88	2.59	57.13	16.86
Dec	13.19	290.78	16.13	355.67	2.94	64.89	18.24
Jan	13.88	306.00	17.59	387.73	3.71	81.73	21.08
Feb	14.79	326.06	18.77	413.75	3.98	87.69	21.19
Mar	11.83	260.80	15.97	352.02	4.14	91.22	25.91
Apr	10.21	225.09	14.79	326.15	4.58	101.06	30.99
May	10.87	239.64	15.59	343.68	4.72	104.04	30.27
Jun	12.10	266.75	16.70	368.07	4.60	101.32	27.53

Source: International Sugar Organization (ISO), London.

**IMPORT PARITY PRICES OF SUGARCANE AT MILL-GATE ON THE BASIS OF FOB (LONDON)
PRICE OF WHITE SUGAR**

S.No	Item	During					
		June 2020	2019-20 (Oct-June)		2017-18 to 2019-20		
		----- US \$ per tonne-----					
1.	Average fob (London) price	368.07	358.34	348.03			
2.	Freight charges upto Karachi	30	30	30			
3.	C & f cost at Karachi port	398	388	378			
4.	Exchange rate (Rs/\$)	166.50	166.50	166.50			
		----- Rs per tonne-----					
5.	C & f cost at Karachi port (Pak rupees)	66279	64659	62942			
6.	Marine insurance @ 0.23 % of c & f cost	152	149	145			
7.	Cif cost at Karachi port	66431	64807	63087			
8.	Landing charges @1% of Cif Value	664	648	631			
9.	L.C opening charges @0.04% of C&f Value	27	26	25			
10.	Bank services charges @0.1% of C&F value	66	65	63			
11.	Provision of shortage & unforeseen losses @0.25% of C&F	166	162	157			
12.	Stevedoring charges	725	725	725			
13.	Clearing & forwarded charges	8	8	8			
14.	Misc: Exp 0.05% of of C&F value	33	32	31			
15.	Wharfage & Weightment	54	54	54			
16.	Importer's profit 2% of C&F value	1326	1293	1259			
17.	Transport charges for up country	2200	2200	2200			
18.	Incidental charges incurred on imported sugar	5269	5213	5154			
19.	Ex-mill/ market cost of imported sugar	71700	70020	68240			
		Punjab	Sindh	Punjab	Sindh	Punjab	Sindh
20.	Processing cost of sugar (a)	17925	17925	17505	17505	17060	17060
21.	Value of cane to produce one tonne of sugar (item 19-item 20)	53775	53775	52515	52515	51180	51180
22.	Provincial base sugar recovery (Percent) (b)	10.31	10.82	10.31	10.82	10.31	10.82
23.	Quantity of cane in tonnes required to produce one tonne of sugar ((100/ item 22)	9.70	9.24	9.70	9.24	9.70	9.24
24.	Price of one tonne of sugarcane (item 21/item 23)	5544.17	5818.42	5414.30	5682.13	5276.69	5537.71
25.	Price of 40 kgs of cane	221.77	232.74	216.57	227.29	211.07	221.51

Note:

- (a) Ratio of cost of cane to processing cost has been estimated at 66:34 from publication " Cost of Production of Sugar " jointly prepared in 1996 by APCOM and Business & Consultancy Services.
- (b) Due to current sugar crises, the sugar recovery is not available, last years recovery has been used for calculation.

Sources:

- i) For average fob (London) price: International sugar Organisation.
- ii) For freight, incidentals and duties: Trading Corporation of Pakistan, Karachi.

**EXPORT PARITY PRICES OF SUGARCANE AT MILL-GATE ON THE BASIS OF (FOB LONDON)
PRICES OF WHITE SUGAR**

S.No	Item	During					
		June 2020		2019-20 (Oct-June)		2017-18 to 2019-20	
		----- US \$ per tonne-----					
1.	Average fob (London) price	368.07		358.34		348.03	
2.	Exchange rate (Rs/\$)	166.50		166.50		166.50	
		----- Rs. per tonne -----					
3.	Average fob Karachi price (assuming equivalent to fob London price)	61284		59664		57947	
4.	Transport charges from interior Sindh to port, special packing, inspection transit insurance, loading and unloading, clearing and forwarding and port terminal charges	18000		18000		18000	
5.	Bank commission @ 1.25 % of fob price	766		746		724	
6.	Inspection charges	429		429		429	
7.	Ex-mill price of sugar (item 3 minus items 4 through 6)	42089		40489		38794	
		Punjab	Sindh	Punjab	Sindh	Punjab	Sindh
8.	Processing cost of sugar (a)	10522	10522	10122	10122	9698	9698
9.	Value of cane to produce one tonne of sugar (item 7-item	31566	31566	30367	30367	29095	29095
10.	Provincial base sugar recovery (Percent)	10.31	10.82	10.31	10.82	10.31	10.82
11.	Quantity of cane in tonnes required to produce one tonne of sugar ((100/ item 10)	9.70	9.24	9.70	9.24	9.70	9.24
12.	Price of one tonne of sugarcane (item 9/ item 11)	3255	3415	3131	3286	3000	3148
13.	Price of 40 kgs of cane	130.18	136.62	125.23	131.43	119.99	125.92

Note:

- (a) Ratio of cost of cane to processing cost has been estimated at 66:34 from publication "Cost of Production of Sugar " jointly prepared in 1996 by APCoM and Business & Consultancy Services.

Notes:

- i) For average fob (London) price: International sugar Organisation.
- ii) For incidentals and duties: Trading Corporation of Pakistan, Karachi.
- ii) For transport charges: Arian Cargo Transport Agency, Karachi.

**MILL-GATE PRICES OF SUGARCANE WORKED BACK FROM THE EXPECTED WHOLESALE MARKET PRICES
OF SUGAR DURING 2019-20**

S.No	Item	WORKED BACK PRICES OF SUGARCANE									
		-----Rupees per tonne-----									
1.	Average wholesale market prices of sugar (a)	65000	70000	75000	80000	85000					
2.	Wholesale dealer margin @5% on net price	2876	3097	3319	3540	3761					
3.	Sales Tax @ 17%	9779	10531	11283	12035	12788					
4.	Net price of sugar (items 1-2-3)	57522	61947	66372	70796	75221					
		Punjab	Sindh	Punjab	Sindh	Punjab	Sindh	Punjab	Sindh	Punjab	Sindh
5.	Processing cost of sugar	14381	14381	15487	15487	16593	16593	17699	17699	18805	18805
6.	Value of cane to produce one tonne of sugar (item 4- item 5)	43142	43142	46460	46460	49779	49779	53097	53097	56416	56416
7.	Provincial base sugar recovery (%)	10.31	10.82	10.31	10.82	10.31	10.82	10.31	10.82	10.31	10.82
8.	Quantity of cane in tonnes required to produce one tonne of sugar ((100/ item 7)	9.70	9.24	9.70	9.24	9.70	9.24	9.70	9.24	9.70	9.24
9.	Price of one tonne of sugarcane (item 6/item 8)	4448	4668	4790	5027	5132	5386	5474	5745	5816	6104
10.	Price of 40 kgs of cane	177.92	186.72	191.60	201.08	205.29	215.44	218.97	229.81	232.66	244.17

Note

- (a) Ratio of cost of cane to processing cost has been estimated at 66:34 from publication " Cost of Production of Sugar " jointly prepared in 1996 by APCOM and Business & Consultancy Services, Islamabad
- (b) Due to current sugar crises, the sugar recovery is not available, last years recovery has been used for calculation.

Source:

For FED: FBR, Islamabad.

**YIELD PER HECTARE OF MAJOR SUGARCANE PRODUCING COUNTRIES
IN THE WORLD:2019 CROP**

S.No.	Country	Yield / ha	S.No.	Country	Yield/ ha
1	Peru	12548.76	22	Mauritius	7558.15
2	Egypt	11574.27	23	Australia	7483.56
3	Senegal	11325.47	24	Brazil	7468.33
4	Guatemala	10767.25	25	Mexico	7454.18
5	Malawi	10756.13	26	Mali	7244.09
6	Chad	10378.29	27	Thailand	7138.75
7	Zambia	10332.47	28	Colombia	7135.03
8	Burkina Faso	10098.15	29	Panama	7113.32
9	Eswatini	9642.11	30	Costa Rica	7059.25
10	Nicaragua	9557.15	31	United Republic of Tanzania	6991.00
11	El Salvador	8864.55	32	Sierra Leone	6978.63
12	French Polynesia	8845.00	33	Mozambique	6953.85
13	Honduras	8684.13	34	Uganda	6893.70
14	C?te d'Ivoire	8217.56	35	China, Taiwan Province of	6649.10
15	Iran (Islamic Republic of)	8205.87	36	Haiti	6616.49
16	India	8010.45	37	Indonesia	6560.42
17	United States of America	7839.80	38	Viet Nam	6542.66
18	Zimbabwe	7743.48	39	South Africa	6524.29
19	China, mainland	7736.06	40	Myanmar	6503.24
20	Sudan	7663.85	41	Pakistan	6432.15
21	Ecuador	7599.99		World average	7664.79

Source: World statistics year book 2019

Annex-XXIII**COMMERCIAL SUGARCANE VARIETIES DEVELOPED AND RELEASED THROUGH
COORDINATED SUGAR CROPS RESEARCH PROGRAM OF THE PARC**

S. No.	Name of variety	Name of Institute	Year of Release	Maturity	Cane Yield (t/ha)	Sugar recovery (%)
Punjab						
1.	BF-162	AARI, Fsd.	1990	Early	100	10.5
2.						
2.	SPSG-26	SRI, Jhang	1991	Early	100	10.2
3.	BF-129	AARI, Fsd.	1996	Mid	100	9.8
4.	CP-43-33	AARI, Fsd.	1996	Early	90	10.8
5.	CP-72-2086	AARI, Fsd.	1996	Early	90	12.0
6.	CP-77-400	AARI, Fsd.	1996	Early	100	12.7
7.	CPF-237	AARI, Fsd.	2000	Early	95	12.5
8.	SPF-213	AARI, Fsd.	2000	Mid	100	11.0
9.	HSF-240	AARI, Fsd.	2002	Early	130	12.5
10.	SPF-234	AARI, Fsd.	2002	Early	100	11.6
11.	SPF-245	AARI, Fsd.	2004	Early	100	11.0
12.	HSF-242	AARI, Fsd.	2006	Early	108	12.4
13.	CPF-243	AARI, Fsd.	2006	Early	102	12.7
14.	NSG-555	SRI, Jhang	2008	Mid	119	10.1
15.	NSG-311	SRI, Jhang	2008	Mid		
16.	CPF-246	AARI, Fsd	2010	Early	105	12.0
17.	CPF-247	AARI, Fsd	2010	Early	105	12.5
Sindh						
18	Ghulabi-95	ARI, Tandojam	1996	Early	200	10.7
19	NIA-98	NIA, Tandojam	1998	Mid	180	10.5
20	Thatta-10	NSCRI, Thatta	2004	Early	180	11.0
21	NIA-2004	NIA, Tandojam	2004	Mid	170	9.5
22	LRK-2001	QAARI, Larkan	2005	Early	200	11.0
KPK						
22.	CPM-13	SCRI, Mardan	1989	Early	70	12.5
23.	CO-1321	SCRI, Mardan	1989	Early	70	12.0
24.	Mardan -92	SCRI, Mardan	1992	Mid	100	12.0
25.	Mardan -93	SCRI, Mardan	1993	Early	100	12.5
26.	CP-77-400	SCRI, Mardan	1996	Mid	80	12.7
27.	Jn-88/1	SBS, Dargai	1996	Early	70	12.7
28.	Abid-96	SBS, Dargai	1996	Early	70	12.5
29.	SN-98	SCRI, Mardan	1998	Early	72	12.2
30.	MCP-421	SCRI, Mardan	2003	Mid	80	12.5
31.	Mardan-2005	SCRI, Mardan	2005	Early	90	12.2
32.	KB-2010	ARS, Bannu	2010	Early		

Source: PARC

