

THE PAKISTAN SUGAR INDUSTRY ITS CURRENT STATUS AND FUTURE NEEDS

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The small sugar industry can afford to idle along using Research and development (R & D) produced (and paid for) by other sugar industries but when it is big with world standards it's a different matter (19). This study was important because Pakistan is 5th largest producer of sugarcane but it still lacks major advancement in production and marketing. The largest producers are Brazil, India, Thailand, China, and Pakistan accounting for more than 70% of world production. Brazil has the highest area (5.34 million hectares) while Australia has the highest productivity and sugarcane yield (85 tons per hectare). Sugarcane is the second largest cash crop of Pakistan and is being cultivated on 1.06 million hectares with 55 t ha cane yield and sugar yield of 5.5 t ha, contributing around 3.6 % of Gross domestic production. The installed capacity of 85 sugar factories is to produce 7.5 million tons of refined sugar and domestic demand is around 4.5 million tons. This shows it's export potential of 3.5 million tons, annually (16 and 17).

Currently sugarcane

accounts for 4.8% of cropped area and 11% value-added of the total crops. The sugar industry plays a pivotal role in the national economy of our country. Sugarcane provides sugar, besides biofuel, fiber, organic fertilizer with ecological sustainability. Molasses is the cheapest feedstock for the distilleries and livestock. The bagasse has been accepted as a viable alternative raw material to the wood in the paper and pulp industry (14). The sugar industry contributes around 5 billion rupees under the head of general sales tax and other indirect taxes levies to the Govt. The industry employs over one million people, including management experts, technologists, engineers, financial experts, in addition to skilled and unskilled workforce. The sugar industry contributes substantially to the rural economy as the mills are located in rural areas (18).

Back in 2007, raw sugar prices on the world market averaged just shy of 10 cents per pound. To put that figure into perspective, the global average cost of producing a pound of raw sugar was more

than 17 cents. Yes, the price was low and producers were losing money on every pound of sugar sold. But amazingly, it was up more than 10% from the 8.8 cents per pound it averaged the decade before. Then, things changed. Major subsidized exporters had short crops and shipped a lot less. By 2011, prices nearly tripled, shooting up to an average of 27.2 cents for the year. Of course, that didn't last long either. Prices plummeted 50% by 2015 as exporters ramped up production and sent prices back to an average of 13.14 cents. Yet, less than a year later they are moving back up again, settling above 16 cents last week. Such huge and unpredictable price swings are not typical of other crops, which is one reason sugar has been called the world's most volatile commodity market. And making business decisions based on this yo-yo market alone, without government support, is impossible. So what's causing all of the turmoil, and what are sugar producers around the world doing to cope? The same answer applies to both questions: Subsidies (15).

The world sugar market is thinly traded and is comprised of surpluses that exporting

countries seek to remove from domestic markets before it collapses prices at home. These exports are made possible by an array of subsidies and other governmental actions that have a tremendous impact on prices. Brazil, for example, used \$2.5 billion a year in subsidies and support to its sugar ethanol complex to grow an empire that controls half of the global sugar trade. With that kind of market domination, every government action or planting decision sends prices sharply in one direction or another. Then, there's Thailand. Thailand subsidizes its sugar industry at least \$1.3 billion a year and is still making investments to expand production and exports, with encouragement from the government to shift the country's rice acreage into sugarcane (15). Last, but certainly not least, in India. WTO-illegal sugar export subsidies helped the country move from an importer of sugar to an exporter. India justified its subsidization by saying it was needed in times of low prices. Does that mean it plans to roll back all of its subsidies now that prices are climbing? Not exactly. As Reuters recently reported, "India seen holding off sugar policy change despite price surge." The Wall Street Journal also quoted an Indian government official saying, "We will not deviate from our duty of farm welfare." It is truly a subsidized market right now. Even Europe, which undertook reforms of its highly subsidized sugar

policy, will still provide its sugar growers an estimated \$665 million a year after reform is completed in 2017. So what can unwind all of the turmoil and inject some common-sense, free-market philosophies into this distorted mess? That answer is simple: End subsidies around the globe. And that's exactly what U.S. sugar producers are supporting in the Zero-for-Zero sugar policy (15)

The lesson for Pakistan sugar industry from the Cuban sugar industry, which was capable of producing up to eight million tons of sugar per year, hit the bottom in 2010 when total sugar production tumbled to 1.1 million metric tons, the lowest level in 105 years. The situation is beginning to improve, and the administration is taking some important measures to boost efficiency and increase production (15 and 17).

Area, productivity and utilization

Sugarcane cultivation requires a tropical or subtropical climate, with a minimum of 600 mm annual rainfall. In Pakistan sugarcane is cultivated in three ecological zones i.e. northwestern, central, and southern zones. Climatic conditions of lower Sindh (southern) are more favorable having a hot and semi-humid climate. The climate of Pakistan is mainly subtropical arid to semiarid. Temperature ranges from a mean of minimum 4 °C during December and

January, a maximum of 38 °C during June and July. Although in very small tracts the minimum temperature during winter sometimes retards or stops sugarcane growth. The climate generally favours crop productivity throughout the year. But inclement weather conditions specifically limited amount of rainfall is a critical factor for sugarcane crop production hindrance in Pakistan (11 and 14).

Despite all efforts, sugarcane production in the country is still much lower than most cane growing countries of sugar world. Amongst the many constraints responsible for low productivity, inappropriate plant population, substandard method of cultivation, poor nutrition management, inadequate irrigation water supply, and lack of plant protection practices are the major ones and need immediate attention. During the last 69 years, an area under sugarcane increased 310%, production 566%, cane yield 200%, and sugar recovery 23% as a national average improved from 7.50 to 9.75% (17 and 18).

Total area and cane yield (Table-1a) and cane produced, installed capacity of sugar factories, and utilization percentage (Table-1b) show that all the available cane was utilized by the factories. The utilization of sugarcane by the factories during low yield years ranged 62 % and high production

years it was 75%. So assuming 80% utilization during coming crushing seasons is merely a wishful thinking. The diversion

towards gur production has always been more attractive during the short supply of sugarcane. If new factories are installed or existing units

are being expended, they should be aware that they have to put in special efforts to enhance cane productivity for this new capacity (18).

Table-1a:Area, production and cane yield, Pakistan (1947-15)

Years	Area "000" ha	Cane yield M. t ha
1947-55	245	29.2
1955-65	468	33.7
1965-75	608	35.7
1975-85	896	37.5
1985-95	927	43.9
1995-05	1020	46.9
2005-15	1021	52.0

(Source PSMA Annual Report 2015)

Table-1b:Cane produced, cane crushed and utilization percentage (1995-2015)

Year	1995-2000	2000-2005	2005-2010	2010-2015
Sugarcane production (000 tons)	45229	41998	42000	55590
Installed capacity (000 tons)	54300	54750	55800	76250
% age of utilization	62	65	69	75

(Source PSMA Annual Report 2015)

Status of research work

Eleven research institutes (two in private sector) are working on multifarious aspects of sugarcane crops in different ecological zones, out of which six in Punjab, three in Sindh, and two are in NWFP (21). Research work done in above-mentioned institutes on important aspects is development of new cane varieties, biological control of insect pests, tissue culture propagation of elite clones, studies on disease tolerance and insect resistance, agronomic trials, soil and water advisory services, workshops/seminars on R & D activities on sugar crops and technical training of scientists in the country or abroad (29).

Major agronomic factors to improve productivity

Integrated management of high yielding varieties, irrigation water, nutrition, and pests of plant and ratoon crops has shown the capability of producing cane and sugar yield at a lower cost than could be attained with existing practices. During the last fifty years, sugarcane varieties that have shared significance were only 10. IN Australia during the last 50 years, more than 100 cane varieties have been released with a significant impact on cane and sugar production. In Pakistan, monoculture variety trend has always been dominant due to lack of breeding program at sugar industry level. Mostly it was observed that the cane variety

released from any source with approved or unapproved status when and if it was acceptable for the cane growers it was unacceptable for the industry and the varieties or vice versa, it has never been win a winning game at both ends (20).

It is the law of thumb of the world's sugar industry that area under a very good sugarcane variety must not be more than 20 to 25 percent of the total sugarcane area. This has been adopted to avoid unexpected epidemics. This rule is not operative in Pakistan sugar industry. Unapproved varieties are being propagated and no measure is being taken to replace existing unapproved varieties (28). Biometric

characteristics of cane varieties recommended for general cultivation in different provinces are given in table-2.

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Table-2:Biometric characteristics of sugarcane varieties (2002-2005)

Sr. No.	Varieties	Maturity	Yield (t/ha)			Disease-Reaction (Combined)
			Spring	Autumn	Ratoon	
	Punjab					
1.	CPF-246	Medium	85	110	60	R
2.	CPF-248	Medium	75	100	65	R
3.	NSG-59	Medium	120	135	125	R
4.	NSG-555	Early	90	110	80	R
5.	HSF-240	Medium	70	80	65	MS
6.	SPF-234	Medium	75	80	65	MS
7.	CPF-243	Medium	77	85	75	R
	Sindh					
1.	SPSG-26	Early	125	125	80	MS
2.	NIA-98	Medium	129	132	125	R
3.	Lark-2001	Medium	126	141	114	R
4.	BL-4	Medium	110	120	105	MS
5.	Thatta-10	Very early	114	120	100	MR
6.	SPF-234	Medium	120	130	110	MS
	NWFP					
1.	Mardan-93	Early	116	120	110	R
2.	S87US-1873	Early	117	125	110	R
3.	SPSG-394	Early	150	160	150	MR
4.	CP77-400	Early	90	100	80	MR

Alarming Note: Major varieties (HSF-240, SPF-234 are MS and CP-77-400 is MR for combined resistance)

Irrigation management

Pakistan ranks fifth in the world and third among the developing nations in terms of the size of its irrigated area. It's 4:1 ratio of irrigated to non irrigated agriculture which is the highest in the world. Canal command area is 16.2 million ha out of the total cultivated area of 20.6 million ha. However, despite the extent of this canal system, it supplies only 70 % of the gross water requirements of sugarcane.

In Pakistan water is the main constraint and costly input affecting cane

and sugar yields. It has been worked out that to produce one ton of cane, 200-250 tons of water is required. The availability of water of sugarcane crop is almost static, even decreasing in cane growing areas over the years. There is an imperative need to optimize the production of sugarcane by efficiently managing water resources and their reliability. About 50-70 % of water is lost through surface evaporation, run-off leaching beyond root zone, and transpiration by weeds. Anytime water becomes

limiting factor growth is reduced so does yields. Cane variety, water deficit severity, and the stage of development affect the amount of yield reduction. The efficient utilization of water is the only alternative to increase the productivity of the soil. Adaptation of these valuable practices would be helpful for profitable cultivation of sugarcane in Pakistan. The practices that could give conservation of 12.5 to 40 % irrigation water are reduced cultivation at early crop stage, the addition of

organic matter in soil, use of stress-tolerant cane varieties like HSF-240, irrigation scheduling, land leveling, weed control, drip irrigation and trash mulch of ratoon crop (6 and 26).

Nutrient management

Soil testing before planting is desirable as it helps in determining the optimum quantity of macro and micronutrient applications. Chemical constraints in the soil, such as salinity/sodicity and low fertility, are relatively easy to correct or control, which can make a great difference in crop yield. The nutrient requirements of sugarcane, especially for NPK are higher than any other commercial crop because it is a C4 plant having the potential of higher net assimilation rate and CO₂ fixation per unit area. Normally a crop yielding 125-t ha removes about 84 kg N, 67 kg P, and 168 kg K. Our soils are universally deficient in nitrogen, about 90 percent lack adequate content of phosphorus, while 40-50 percent has insufficient potash to support bumper crops. Fertilizer use status in sugarcane has shown that 22% of farmers use N alone, 75% farmers use N + P and only 3 percent use a balanced dose of NPK (9 and 12).

Pest management

Weeds compete with sugarcane for light after

germination, mineral nutrients, and moisture throughout the growing period, which causes the greatest loss of cane and sugar yield. A method of weed control which could suppress weeds from initial 90-120 days would leave the sugarcane crop in a condition when it can keep weeds under control through smothering (7).

Disease control

This aspect of the sugarcane crop has been mostly ignored and attention has not been given to keep the crop free from diseases. Major diseases are red rot, whip smut, pokkah boeng, red stripe, rust, and sugarcane mosaic virus (27). According to an estimate, 10 to 77% losses are caused in cane yield due to different diseases and they also affect sugar recovery from 4 to 74 % (10 and 22). Red rot, some times cause the destruction of the whole field. Sugarcane mosaic is present in almost all the varieties with varying intensity and causes 10 to 20% losses in different varieties (23, 24 and 25).

Biocontrol of insect pests

Bio-control of insect pests is most efficient, economical and eco-friendly. Worldwide emphasis is given on this useful tool because chemical control of sugarcane insect pests creates health hazards, relatively less effective and costly. The research and

development work is rather scanty in Pakistan. *Trichogramma chilonis* is an egg parasite of borer complex and *Chrysoperla carnea* is an effective predator of most insect pests (25).

Ratoon management

Ratoon is an integral component of raw material production through-out the world. The cane yields, thus, are greatly influenced by low ratoon yields as they contribute 40-50 percent to the total cane production in Pakistan (1). With so little share in total production particularly when its area is high, low ratoon yields are indeed an alarming challenge to sugarcane cultivation. Research work done so far on the production technology of ratoon crops is not more than nothing (2). Successful ratoon cultivation economizes cane and sugar production. At present, there is an appreciable gap between cane and sugar yield of plant and ratoon crops. There is an urgent need to elucidate behavioral differences between productivity gaps (4). How best we can improve upon the existing productivity of sugarcane, research work on ratoon management technology should be started as early as possible. The intensity of sugarcane ratooning in various parts of the world is presented in table-3.

Table-3: Intensity of sugarcane ratooning in various parts of the world

Ratoon intensity	Countries
Plant Crop	China and Indonesia
Plant Crop + 1 ratoon crop	Pakistan and Fiji
Plant Crop + 2 ratoon crops	India, U.S.A., Hawaii and Taiwan
Plant Crop + 2-3 ratoon crops	Australia, Brazil and Mexico
Plant Crop + 3-4 ratoon crops	Dominican Republic and Panama
Plant Crop + 4-6 ratoon crops	Barbados, Jamaica and Reunion
Plant Crop + more than 6 ratoon crops	Mauritius and Zaire

Economics of cultivation

The cost of cultivation of sugarcane has steeply increased because the crop is labour and input-intensive

(3). Harvest and transport costs, non-availability of labour are rising costs of this bulky crop. The cost of production (ha) is given in

table-4. This indicates high cost of inputs is eroding the profits, making sugarcane a "high cost" crop.

Table-4: Cost of production of sugarcane crop on the non-rental basis (Rs. ha⁻¹)

Sr. No.	Description	Plant crop	Ratoon crop
1	Pre sowing	7200	-
2	Seed & sowing	20050	-
3	Fertilizer	12250	11250
4.	Weedicide	2500	2500
5.	Inter culture /earthing up	1000	1000
6.	Plant protection	3350	3350
7.	Irrigation (18 irrigations @ 875 irrigation ha	25750	15750
8.	Watch & wards	7500	7500
9.	Land revenue & agriculture tax	1250	1250
	Total cost of production ha	80850	42600

Improvement of quality of raw material

The quality of furnished goods is directly proportional to the quality of the raw material. Different techniques in the world are being adopted to improve the raw material. In sugarcane, the time between cut and crush pays a key role in sugar recovery. This is only possible when a scientific cane procurement program is being run. In the present prevailing uncertain situation, no sugar mill is in a position to plan a cane procurement program. The sugarcane crop is being harvested without any procurement schedule. Another practice which is flourishing at a very rapid speed is the procurement of biological

yield of sugarcane instead of economical yield. Before this unethical competition, the percentage of extraneous material did not increase from 4 to 5 whereas now there is no consideration that how much extraneous material is purchased. It has reported that with every 1 percent extraneous matter reduction of sugar recovery was 0.1% (8 and 31).

Transfer of technology

There is considerable scope for improving sugarcane production in Pakistan, using existing knowledge. This will require a demonstration of best farming practices, already being used by the best farmers in the localities, to other farmers. The work

being done by some mills in promoting and demonstrating better cane varieties is a good example. Estimated potential cane yield (t ha) in Pakistan is 150-200 for Sindh province, 100-150 for Punjab province, and 75-100 for NWFP (1 and 3).

Availability of credit facilities

Sugarcane is a long duration and heavy input demand crop. The growers having a millable size of cane supply, are not in a position to raise their crops with their resources. Some agricultural credit facilities were provided by most of the sugar mills up to 1985. The recently established sugar mills did not pay enough attention to cane development activities.

This is an eyewash not serious development, only 1 to 2 percent growers were benefited. As the requirement for agricultural credit still exist a new segment of the community (Middleman) came into action and started investing with the cane growers at the local level. They started giving agricultural inputs on credit and in turn, started supplying the cane to sugar mills against their own names. They also started purchasing cane procurement receipts (CPRs) on commission. This situation proliferated and hard luck to the industry that some mills management also supported the middleman. Now the situation is that the middlemen are doing business on their own terms (5).

Utilization of Cess fund

A fragmented approach of sugarcane research work is being taken by some of the sugar mills on local problems. No collective approach has ever been made to have a collective R & D program. A sugar development cess fund with an equal contribution from growers and mills was created with an idea that enough funds would be made available out this cess to have proper research on sugarcane. The very unfortunate fund which is in billions was specified only for the development of communication network. Some amount from this fund has been given to Sugarcane

Research and Development Board but it is not sufficient for R and D activities at Industry level (4 and 5).

Harvesting and stale cane

The degree of staleness in the cane at crushing was astounding! Delays of many days from cutting to crushing were apparent, from the appearance of the cane and the drying out of the cut ends. Much of the delay occurred in the field, with cut cane not being loaded for some days. Further delays occur in the process of delivery to the factory gate. Delays in the mill yard were too long but reportedly are quite excessive at times. Transloading centres and clusters of increasing middlemen purchasing sites were seen, the latter showing some cane of quite poor quality (8).

Factory situation

Immaturity of the crop and low % recovery made it difficult for factories to produce world standard results. When the cane supply is stale as well, processing problems are greater -reducing sugars and polysaccharides increase, % sucrose and purity decrease, % recovery is reduced, and sugar quality problems increase (13).

Cane payment

Payment for the cane is based on tonnage alone, giving farmers an incentive to produce as large a crop as possible with no need to consider the quality of the product. The state of many

loads of cane in factory yards reflected this - cane stale, dead or rotting stalks visible, high extraneous matter levels. In contrast, some good loads of well-cut, well-cleaned, reasonably fresh cane were also seen. Most loads fell somewhere in between but biased towards the former poor standard. This may not be the case earlier in the year (8).

Research development and extension (R, D & E)

R & D work at Faisalabad S.R.I, and Shakarganj S.S.R.I, was recognized at national and international levels. Problems with inadequate funding for operating costs, travel and equipment were noted at the former. Quality and extent of the R & D could not be assessed adequately in the time available, but Annual Reports have been reviewed subsequently. S.S.R.I, is a very small private organization which has a good library and laboratory facilities for the few disciplines in which it is involved. Variety selection using imported fuzz (true seed) is providing a small number of new varieties. It is better than nothing but cannot substitute for a full cane breeding program. The lack of quarantine facilities for sugarcane was noted. Unauthorized introductions occur and are potentially dangerous in introducing new diseases and pests (1 and 3).

Extension work on sugarcane appears to be unorganized and of little consequence, except for that related to greater uptake of the newer varieties. Overall, I am concerned at the minimal amount of R, D & E in the Pakistan sugar industry. It was inadequate before the big expansion of recent years. Now, it is so inadequate that industry the size of Pakistan must be considered at risk (19).

Analysis of the situation “The Leaks”.

Overall cane and sugar yields in Pakistan are around 56 t/ha cane, 5.5 t/ha sugar and 9.90% recovery, well, below world averages of 65 t/ha cane, 6.5 t/ha sugar and 10.5% recovery. Another the most pressing problems for the sugar industry are The Leaks, “Process Leaks of both known and unknown nature”, if it is ever to become internationally competitive, avoid the leaks and involve in increased cane productivity and more efficient delivery to the factory (8). This is not to say that problems do not exist on the milling side, but they are less important in the short to medium term. Following standard methods of production of course along-with, necessary audits need to be adhered. It is possible to produce high yielding crops of sugarcane, both in plant cane and in ratoons. Many growers have demonstrated this, but very many others have very low yields (13 and 31).

Constraints to better cane productivity.

substandard farming techniques
 ±inadequate varieties
 ±insufficient fertilizer
 pest and disease damage
 ±inefficient harvesting and cane transport
 excessive cut-to-crash delays
 regressive cane payment system based on tonnage
N .B. In no way is this intended as criticism of the research work being carried out by existing staff at the various research institutes.

Value for money invested

Most manufacturing businesses consider that secure supplies of good quality raw material are at least as important as building an up-to-date factory. In the Pakistan sugar industry, however, many large modern factories were erected without providing adequate inputs to expanding the cane supply. Prudent investment by the factories, to help farmers produce higher average yields of better quality cane, will show a handsome return. A premium product is worth money to both growers and mill growers (19).

RECOMMENDATIONS

These are broadly based recommendations" rather than 'recipes' which can be followed blindly. They require mature consideration and action on the part of individual factories, the Pakistan Sugar Mills Association, the Pakistan Society of Sugar Technologists, cane growers, and Government.

Reduce Post-Harvest Losses NOW

Significant financial gains will be achieved in the 1995-96 harvest by refusing to accept stale cane. Reduce the average cut-to-crash delay to 3 days and most factories should obtain at least 0.5% better recovery overall. Many will do much better than that. A few studies suggest that only 25% of cane may have a cut-crash delay of less than 7 days, while significant amounts may be well over 14 days at peak periods. This will vary with location and time of year. Sucrose is made in the field, but too much of it is being lost after harvest unnecessarily. Some studies have demonstrated losses in weight and juice quality after various delay periods for several varieties. Perhaps more research needs to be done now to jolt some mills into action. Fresh cane also means more efficient juice processing for the mills(31).

CONCLUSION

These points are easy to say but much harder to accomplish. Nevertheless, the elimination of post-harvest losses provides for an immediate and substantial return on any funds invested.

Introduce Payment on Cane Quality

A premium product deserves a premium price, and provides financial rewards to both farmers and mills. A legislated system would be preferable, but a negotiated farmer/miller system or voluntary payment by mills

would be feasible. When rubbish and good quality cane are purchased at the same price, the farmer has no incentive to deliver quality and every incentive to deliver the highest weight possible, regardless of what it is. So he grows the low sucrose / high yielding CO-1148, may provide plenty of extraneous matter, and does not worry about the deterioration in sucrose content of stale cane. Premium payments for quality will promote the sweeter varieties, help to eliminate low sugar varieties, and result in a fresher cane supply with less extraneous matter. Milling efficiency and % recovery will improve. All advanced sugar industries in the world have paid on sucrose content for a long time. Thailand, which has increased production even more rapidly than has Pakistan, changed to quality payment in 1994. A changeover will not be easy because of the very large number of small farmers in a mill area, but I note that the concept has been recommended in the past. To become a world competitive, Pakistan must change its current system of payment on gross tonnage (19).

Breed Better Varieties

Establish a cane breeding station in Pakistan or collaborate with SRI Sri Lana or ARS-USDA to produce better-adapted varieties with higher sucrose content, and resistance to

mosaic and other diseases. This is a major key to increased productivity. All major and many minor sugarcane producing countries have active cane breeding programs. It is universally acknowledged as essential for progress. Pakistan does not have the basic breeding facilities for hybrid seed production, and this has definitely affected variety development. Currently, seedlings are raised and selected in Pakistan from true seed produced in other countries (1). This is better than nothing and is producing some new varieties. However, it cannot produce the number and quality of new varieties required. The introduction of foreign varieties is necessary to build up the germplasm bank, for testing both as potential commercials and potential parents. A quality quarantine system is essential for this, and introductions by individuals must be discouraged. However, these foreign canes were not developed for Pakistan conditions and consequently, most will prove to be unsuitable (3). This is also the reason why foreign fuzz is a second class option the parents almost invariable are ones which have never been tested in Pakistan and are not adapted to local conditions. A further problem for Pakistan is that many countries will not give new superior varieties, which have cost a lot of money to produce, to their

competitors. All countries will exchange varieties with others which have a viable breeding program. A cane breeding program is not only essential to help Pakistan become world competitive. It is an essential price of insurance for a large internally important industry which relies on a very small pool of varieties and is subject to disease and pest problem. The cotton debacle of the last few years happens to sugar (2).

Establish A National Sugarcane Research Centre

Establish a national sugarcane research centre using industry and government funding, and controlled by a Board with miller, grower, research and government nominees. Without good R & D, an industry will eventually fade away. When the industry is relatively small, it can beg or borrow information from others, or remain inefficient. When an industry is large by world standards, it is a very different matter. Pakistan can no longer afford the luxury of doing little research in relation to its size. It is a major industry which should invest an adequate amount of money in R & D (2). Again, in no way is this intended as a criticism of research being carried out at various research institutes, which operate under severe constraints. Most major cane growing countries have a significantly R & D effort, and some have been doing that for many years using sugar industry funding, e.g. Hawaii

started in 1995, Australia in 1992, South Africa in 1925. Other countries with good R & D efforts include Brazil, Colombia, Cuba, India, Mauritius, Taiwan, USA. (Florida, Louisiana), mostly with industry funding support (5). All have contributed significantly to advances in productivity in their countries, and have overcome a number of major crises with varieties and diseases. What would you get from adequately funded and staffed research? Better varieties with better yields and better disease resistance, better crop protection practices, better agronomic practices, better milling and processing, and better-informed farmers (3).

The research organization should be controlled by a Board with miller, grower and government representation and some research expertise. PARB is a good effort to improve existing R and D work. Sugar industry members should form a majority of Board members. The industry would, therefore, have direct input into the type of research and emphasis placed on it. Funding should come from both the sugar industry and the government. The latter already provides some sugarcane research stations and recurrent funding, which could be absorbed into a new organization. The sugar industry already pays a large amount of cess to the government. I understand that this is used for road works in cane areas, but that it is possible to use it for other

matter involving the sugar industry. Earmarking a proportion of the Sugar Development Cess Fund for sugar industry research would ensure adequate funding, which would be directly linked to gains in yields due to research. To have any hope of becoming world competitive, Pakistan's sugarcane research must be upgraded (2 and 5).

Improve technology transfer to farmers

Set up advisory services to ensure that current best management practices and new technology developments are transferred to the cane growing sector, and taken up by farmers, as quickly as possible. The best research results in the world will only translate into increased productivity if they are adequately transferred (extended) to the farmers. An advisory/extension service is a very necessary part of any good agricultural system. It can operate in several different ways – through government agriculture departments, industry research institutes, agricultural consultancy companies, farmer organizations, or milling company employees (4).

There is considerable scope for improving sugarcane production in Pakistan, using existing knowledge. This will require a demonstration of best farming practices, already being used by the best farmers in the localities, to other farmers. The work

being done by some mills in promoting and demonstrating better cane varieties is a good example. The local sugar mill is the best organization to undertake this advisory services, at least initially. However, joint miller/grower groups would be a better alternative. Prudent investment by the sugar milling companies, to help farmers produce higher average yields of better quality cane, will show a handsome return. Improvements which can be promoted include better land preparation and planting practices; advice on time of planting; use of healthy planting material of recommended varieties; correct fertilization and cultural practices; hilling up to reduce lodging; weed, pest and disease control; irrigation management; harvesting and delivery management, including avoidance of harvesting stale of immature cane; better techniques for producing good ratoon crops, etc. It is important that those giving advice to farmers must have a good knowledge of cane growing, and be capable of giving sound advice and answering queries. Tertiary training in extension techniques is usually a pre-requisite for this. It would be worthwhile to seek suitable consultants from the private sector or other external experts to ensure that any extension program is soundly based and to run short courses for staff who would be involved (5).

There is a complex of many problems because of the very large number of growers with small landholdings, and their meager financial resources to provide adequate inputs for the crop. Their outputs need to be increased, thus increasing their profitability from cane growing, to ensure a good future for the Pakistan sugar industry (13).

Roll Pakistan Society of Sugar Technologists (PSST)

PSST was established in 1955, with the help of eight founder members, headed by the Late Qayum Ahmed, with following objectives (14).

To help in advancing the science and practice of sugar technology, sugar cane, sugar beet agriculture and manufacture of various by-products of the sugar industry.

To promote and encourage research in sugar technology and sugar cane, sugar beet, agriculture and allied industries.

To help promote the growth of the local engineering industry for the fabrication of machinery for the sugar industry.

To organize conventions, seminars and symposia in sugar technology. Sugar cane/sugar beet agriculture and in the manufacture of by-products to provide opportunities for exchange of knowledge amongst its members.

To collect technical data of the sugar mills and circulate the same to all members at regular intervals to keep them informed about the working of the sugar industry in Pakistan.

To publish proceedings of conventions, meetings and seminars.

To ensure a high standard of professional etiquette and to help safeguard the interest of members.

To raise and administer funds, grant and endowments for the realization of its objects.

To help sugar organizations in the recruitment of the

technical staff for their projects.

To officer technical assistance and advice to organizations.

Alhamd-u-Lillah PSST has successfully steered through in all the disciplines narrated in the objectives above. The results in agriculture, engineering, manufacture, co-products and energy in the country speak about the achievement so far. Seminar and workshops in agriculture and technical on annual bases resulted in a marked improvement in these subjects. Unfortunately, the objective (5) is badly suffering. The sharing of data amongst mills is getting shy year after year. Large sugar industry of the country cannot afford this practice. This will lead to negative progress. The availability of actual technical data does help to sustain the progress in any industry and in any part of the world.

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