Analysis of Sugar Production in South Gujarat Region with Special Reference from Chalthan Sugar Factory

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ABSTRACT *The Indian Sugar Industry accounts for around 1% of GDP of the country in the recent past. There is tremendous scope for India to emerge as a significant player in the world sugar trade [milling and overheads] improvement. This research mainly focuses on the manufacturing process of sugar in south Gujarat region. This paper is concentrate majorly on chalthan sugar factory. For the production purpose, Main components such as brix %, pol %, purity %, fibre, recovery rate was tested whether they are significantly improved or not. Multivariate analysis was used here to test the difference between the productions of verities (86002 & 86032) with respect to ratoon and plantation. Basically the season of Sugar production is seasonal i.e. production runs from October to May. I even interested to measure the monthly sugar production and its variation.*

INTRODUCTION: -

Sugar industry is the second largest agro based industry in India after textile. This is the only industry, which is located in rural part of the country. About 5 crores of sugarcane farmers, their dependents and large mass of labourers are involved in sugarcane cultivation, harvesting and ancillary activities. This constitutes 7.5% of rural population. Besides over 5 lacs of skilled & semiskilled workers, mostly from rural areas, which are employed in the sugar industry, presently industry contributes 15% of the world sugar production. My main focus is on Chalthan Sugar factory(Sugar factory code-10301) situated at chalthan village, in south Gujarat region of Gujarat state, 18 K.m. away from the historic city surat. Factory has receiving sugarcane from 183 villages within a radius of 32 K.m.

REVIEW OF LITERATURE: -

In 2012, DR. MARTINA. R. NORONHA*; PROF. DILIPSINH THAKOR states that Sugar factory should make a fair degree of progress on agricultural efficiency [per hectare output of sugar and cost of production] as well as conversion efficiency, India will surely become a major exporter which will stabilize the industry and reduce its cyclicality significantly, as well as open up new vistas of growth for the Indian Sugar Industry. Productivity in this field is much lower than the Kenya, Egypt, Australia and Columbia. Therefore, now the time has come for the sugarcane grower and the sugar industry to concentrate more on high yielding varieties so as to get required sugarcane from the same area under sugarcane crop. In 2010, Economies of Sugarcane production and process reveals that the possibility of securing even slightly higher level of yield from ratoon sugarcane, when compared with that of planted sugarcane. In 2003, According to Sugar Processing Research Institute, New Orleans, Louisiana SPRI, The research is mostly pre-competitive. Research topics include the role of polysaccharides in processing, flavour and quality of sugar, storage stability of sugar. In addition to conducting research on both beet and cane, SPRI also has a strong focus on the field-factory-product connection. Strong ties with sugar users ensure a research emphasis on product quality. In 1972, Sugar Cane in India by S. V. Parthaswathy discusses soil, climate, botany of sugarcane, land preparation, seed, planting and Inter-culture, pests and diseases. In 1958, Sugar from scarcity to surplus by Hubert gives factual information on many facets of sugar cane cultivation, irrigation system, construction of factories, old and new equipment, trouble shooting, comparative value of different labour forces, role of chemists in scientific quality control and production efficiency.

Research Methodology

Objective of the Study: -
* To determine the top most sugar factory in terms of sugar crushing across the south Gujarat.
* To study the Descriptive behaviour of sugar & sugarcane with the help of graphs.
* To compare Mean Difference between the Production of two Verities with respect to Ratoon & plantation. (viz.86002 & 86032).
* In which year researcher get better production significantly.
* To check whether the average sugar production of all months are equal or not.
* Statistical study about the month wise variation of sugar production.

SAMPLE SIZE
* Seventeen sugar factories of South Gujarat are taken to study the descriptive behaviour of Sugar and sugar cane. (Sugar factories of Bardoli, Madhi, gandevi, chalthan, maroli, valsad, sayan, mahuva, Ukai, mahuva, ganesh, coper, kamrej, pandvai, narmada, padvai, kodinar, talala)
* Month-wise sugar production data from 2003-04 to 2009-10, each year has 8 months of season.

TOOLS FOR ANALYSIS: -
Multivariate analysis, Mann whitney test, ANOVA

Objectives of the study: -
1. To determine top most sugar factory in terms of sugar crushing across the south Gujarat.

Factory	Bardoli	Gandvi	Madhi	Chalthan	Maroli	Valsad	Sayan	Mahuva	Unai
Sugarcane crushed(MT)	1954267	1107100	1210012	1105891	243573	265332	1137206	661029	78961
Factory	Ganesh	Coper	Kamrej	Pandvai	Narmada	Vadodara	Kodinar	Talala	
Sugarcane crushed(MT)	592370	400219	510063	556741	715592	367029	241159	120936	

In above table, During 2009-10, Bardoli Sugar factory achieved first rank in Sugar cane crushing i.e. 19,54,267 MT, Chalthan sugar factory crushed 11,05,891 MT. Ukai Sugar factory had crushed least sugar cane in comparison with other sugar factories.

2. To study the Descriptive behaviour of Suger & Sugarcane with the help of graphs.
Types of sugar cane :
Looking after all the figures, in the beginning of a season in crushing Good sugar cane is high, while in the end season burnt sugar cane is high. In 2008-2009, Burnt cane is 31.06% and good cane is 68.93%.

In above graph, same result displayed as in 2008-09, Burnt cane is 40.64% Good cane is 59.36%.

Types of Sugar: -

	Types Of Sugar (Qtls)					
	2008-09			2009-10		
Month	Small	Medium	Large	Small	Medium	Large
Oct	14720	6550	690	0	8990	2620
Nov	101450	53970	9160	22810	71280	21930
Dec	108770	95630	10910	59920	79030	24750
Jan	111630	95220	11130	67750	87400	29490
Feb	88150	75030	10950	126913	81840	24800
Mar	83480	59080	10940	232497	57190	13150
Apr	13770	4120	840	210831	31140	6750

Well from the above charts conclude that this sugar factory majorly interested in producing the small sized sugar instead large and medium size sugar. The ratio of producing small sized sugar significantly increased in comparison with the previous year.

3. To compare Mean Difference between the Production of two Verities with respect to Ratoon & plantation. (viz.86002 & 86032).
I used here multivariate analysis, as it is not the problem of univariate data. Because researcher is interested to compare two verities of sugar cane with respect to plantation and ratoon.

Plantation:- Plantation is the process in which planting the seeds of cane in a particular period of time. And after the processing period, Farmer are getting the sugar cane. So the process of the planting the seeds is called plantation.

Ratoon:- A new shoot or sprout springing from the base of a crop plant, especially sugar cane, after cropping.)

$H : \mu_1 = \mu_2$ (Average Production of two varieties are same.)
$H_0: \mu_1 \neq \mu_2$ (Average Production of variety 1 is greater than variety 2.)

$$\chi^2_{tab}(\bar{X}_1 - \bar{Y}_1) \left[\frac{S_1}{n_1} + \frac{S_2}{n_2} \right]^{-1} (\bar{X}_1 - \bar{Y}_1) = 0.59349$$

at 5% LOS with 3 d.f

$$\chi^2_{Cal} > \chi^2_{tab}$$

Hence, Null hypotheses is rejecting here

Interpretation

Multivariate analysis concludes that two varieties are significantly differing on the basis of production with two components according to the data.

4. In which year Farmers get better production significantly.
In the context of better production, researcher is comparing

the present production data with the previous year's production data. That will display the performance whether it is improved yet.

More focuses is on different mixtures of sugarcane despite of using only number of sugar. i.e Brix %, Pol % and purity in Primary juice and Mix juice, fibre % in cane, pol % in baggase, expected recovery.

Framed Hypotheses for each component are given below: -

Ho: - Average (Brix %, Pol %, purity % in juices, fibre % in cane, expected recovery) percentage in primary juice of 2008-09 and 2009-2010 are equal.

H1: - Average (Brix %, Pol %, purity % in juices, fibre % in Cane, expected recovery) percentage in primary juice of 2008-09 is greater than Average Brix of 2009-2010.

For every component mentioned above has the result like this:

	Mann-Whitney U Statistic	Sig. (1-tailed)	comparison	Conclusion	Interpretation
Primary juice:					
Brix%	9703.000	.000	$P < \alpha$	Reject H_0	Purity of primary juice in 2008-09 is better than 2009-10
Pol%	8382.500	.000	$P < \alpha$	Reject H_0	
Purity	7756.500	.000	$P < \alpha$	Reject H_0	
Mix juice:					
Brix%	7908.500	.000	$P < \alpha$	Reject H_0	Purity of mix Juice in 2008-09 is better than 2009-10
Pol%	7616.000	.000	$P < \alpha$	Reject H_0	
Purity	7415.000	.000	$P < \alpha$	Reject H_0	
Fibre % cane:	12823.000	.238	$P > \alpha$	Do not Reject H_0	Fibre % in cane in 2009-10 is equal to 2008-09
Pol% in Bagasse:	6315.000	.000	$P < \alpha$	Reject H_0	Pol% in bagasses in 2009-10 is more than 2008-09
Expected recovery:	7452.000	.000	$P < \alpha$	Reject H0	Expected Recovery in 2008-09 is better than 2009-10

5. To check whether the average sugar production of all months are equal or not.
Researcher has to find whether the average sugar production is same or not for all months, therefore Anova technique is better to apply in this case.

H0: The average production for all months is equal.

H1: At least one month's average production is differing from the other month.

ANOVA
Sugar

|	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2842879531.857	7	406125647.408	36.623	.000
Within Groups	532288126.857	48	11089335.976		
Total	3375167658.714	55			

Interpretation:
Here p value is less than 0.05. Hence; Null Hypotheses is go-

ing to reject at 5% level of significant.

i.e. At least one month's sugar production is differ from the other months sugar production during this time period.

6. To Study the variation in Sugar for the Year 2003-04 to 2009-10:

Month	Oct	Nov	Dec	Jan	Feb	March	April	May
2003-04		19086.5	20577.5	20201	21801	20571	17134	5764
2004-05	4202	16935	23832	22141	20260	10142		
2005-06	3196	11984	21126	21355	21075	20754	17950	
2006-07	4437	16639	20533	19899	19804.5	18867.5	16311	6126
2007-08	6629	15682	21680	20821	17395	17015	14728	
2008-09	3012	18783	22248	21780	18429	18674	3614	
2009-10	3054	18232	19785	20857	18441	17592	15506	4135

From the above chart of month wise sugar production researcher observed that data are seasonal.
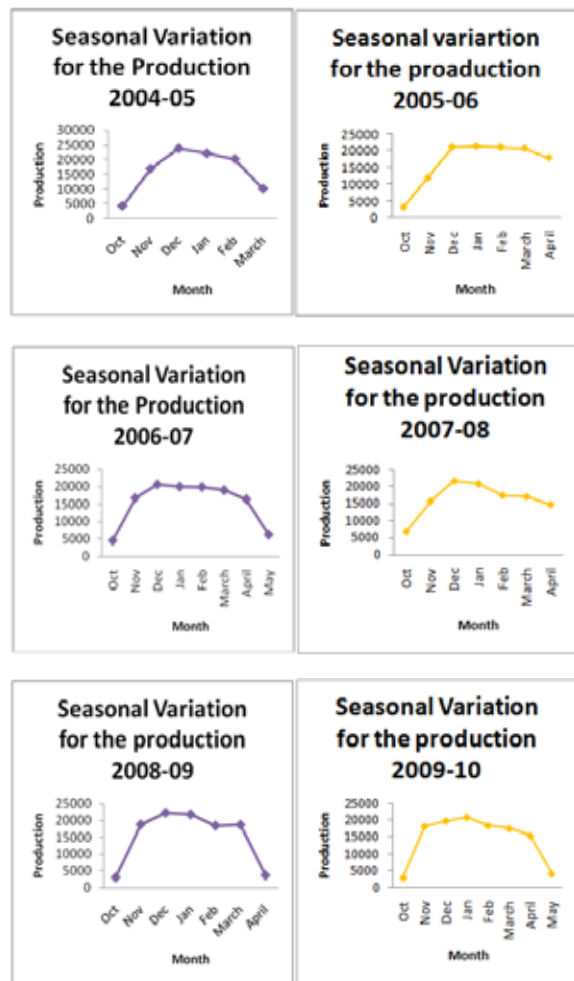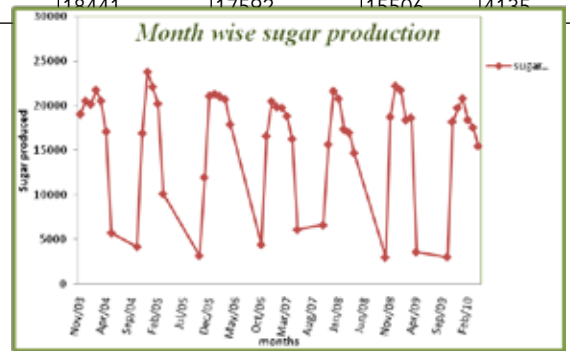
Interpretation

From the above graph researcher can observe that

- Production is almost highest in December
- Production is almost lowest in October or May

Above charts states that sugar production is increases during October to January and after it decreases for all years.

Findings:

- researcher observed that in year 2008-09 the proportion of Burnt sugarcane is 31.06% and Good sugarcane is 68.93%.
- In year 2009-10 proportion of Burnt cane is 40.64% and Good cane is 59.36%.
- Also it's clear that in the beginning of a season the crushing of good cane is high and at the end of a season the crushing of burnt cane is high.
- There are mainly three types of sugar produced in chalthan sugar factory and Average proportion of the small, medium and large sugar is 0.4412, 0.4299 and 0.1289 respectively.
- In starting of the season (Oct to Feb) the proportion of medium sugar is more than the small and large and in the end its reverse occurs. In the entire season the proportion of large sugar is less than the other which is between 2 % to 22 %.
- In primary juice the average sugar pol % of 2008-09 is 15.68% and of 2009-10 is 15.34%, average Brix % is 18.82% and 18.57%, average purity % is 83.26% and 82.62 % respectively.
- In mix juice the average sugar pol % of 2008-09 is 12.37% and of 2009-10 is 11.96%, average Brix % is 15.12% and 14.75%, average purity % is 81.77% and 81.09% respectively.
- Average Expected recovery of 2008-09 is greater than Expected recovery of 2009-2010.
- Pol percentage in Bagasse of 2009-10 is greater than pol percentage in bagasse of 2008-2009.
- Fibre percentage in Cane of 2009-10 is equal to Fibre percentage in cane of 2008-2009..
- It is seen that in the beginning and at the ending of the season, sugar production is decreasing. It is because of the less availability of sugar cane.
- From the data of monthly sugar production of last seven years, researcher can conclude that there is seasonality in sugar production. Lots of variation is seen in the production of Sugar.

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