

COMPUTERIZED MODEL FOR SUGAR CANE HARVESTING FOR EFFECTIVE PLANNING AND CONTROL IN CO-OPERATIVE SUGAR FACTORIES IN PUNE DISTRICT

Dnyaneshwar Pisal¹, Dr. Ajay Kumar², Vikas Kakade³ and Nilesh Chavan⁴

¹Assistant Professor, SVPM's Institute of Management Malegaon (bk)
Email: pisaltdt@gmail.com

²Director, JSPM, JICA Tatawade Pune
Email: ajaykumar19_61@rediffmail.com

³HOD, Computer Science T.C.College, Baramati
Email: vikas.c.kakade@gmail.com

⁴HOD, Computer Science, CCSCE Malegaon(bk)
Email: chavan.nilesh@yahoo.co.in

ABSTRACT

India produced 18.8 million tons of sugar in 2009-10, which was 3.8 million tons higher than the initial estimation. Sugar and sugarcane production in India typically follow a 6 to 8 year sugar cycle, wherein 3 to 4 years of higher production followed by 2 to 3 years of lower production. After two consecutive years of declining sugar production (2007-08 and 2008-09), production resurged in 2009-10, and is set to gain strongly in the year 2010-11. The demand supply flow affects the sugar industry and the sugarcane growers. The industry faces the problem of excess sugar in the consecutive years when the sugarcane production is higher, the sugarcane harvesting needs to be well planned so the sugar mills can get the matured and fresh cane and the sugar growers can be benefited by timely harvesting of their sugarcane which will affect for better sugar cane yield, the losses occurred duly by non harvesting of sugarcane in proper time can have a big loss to sugarcane grower, as well as sugar mills because of unsecured environmental factors changing day by day which ultimately change the mindset of sugarcane grower and attract to different cash crops . The post harvest sugar lose is one of the most vexing problems of sugar industry and has attracted widespread attention in the recent years.

Keywords: Sugarcane harvesting, Cost efficiency, Quartiles, Sugar production

INTRODUCTION

India produced 18.8 million tons of sugar in 2009-10, which was 3.8 million tons higher than the initial estimation. This can be attributed to the bountiful rains resulting in a substantial

rise in sugar production in two main sugar producing states viz. Maharashtra and Uttar Pradesh. Favorable weather conditions and better price for sugarcane contributed to further expansion of the area under sugarcane which may result in production of around 25 million tons of sugar during 2010-11 seasons. A critical and complex situation may emerge in 2010-11 season as the farmers have planted sugarcane on much larger area as this year they received better cane prices during the last two seasons. The post harvest sugar loss is one of the most alarming problems of sugar industry and has attracted widespread attention in the recent years.

In Maharashtra year 2009-10 1.1 million hector area under sugarcane and it is expected that 8.5 million tons of sugarcane will be available for crushing. Untimely rain and farmer agitation in some parts of the state did not allow early start of the crushing season in the first week of October. Strenuous efforts are required to harvest and crush all the standing cane and the industry may have to extend the crushing season. This is crucial task before the industry and the state authorities to gear up the sugar industry to crush all standing cane and derive maximum benefits for sugarcane growers. Surplus sugarcane production leads to surplus sugar and depress sugar prices consequently affecting the revenue of the sugar mills, such a situation affect the economic capacity to make reasonable and timely payment to growers. As a result growers lose the interest in sugarcane cultivation and switch to other crops, low sugar production gives rise to higher sugar prices resulting better revenue and promoting sugarcane plantation on large scale. This cycle of 'boom and bust' has been a salient feature of the Indian sugar industry.

The sugar industry is controlled by Government of India and which result the main decisions in the hand of the government and not in the hands of sugar mills, as this industry faces many problems as short margin, persistent losses in sugar recovery and losses in the sugar manufacturing due to old machinery and lack of new technology for producing of sugar. The main losses are accountable in losses in molasses, baggasse, and filter cake and undetermined. The stock of sugar and marketing of the sugar is in the hands of government which is controlled will affect the stock of sugar and the margin money increases which creates the losses to the sugar mills. The labor problem for sugar harvesting is the big problem before this industry. As it affect the harvesting of the sugarcane which is also the major expenditure done by the sugar mills, the researcher tried to focus on the problem of harvesting of sugarcane which must be well planned and the assured sugarcane harvesting should be done by the harvesting mechanism. The sugarcane harvesting should be timely and matured sugarcane should be made available to the sugar mills so that the sugarcane growers will get more yield of sugarcane which will boost the sugar cultivation area. This paper focuses on the computerized model for harvesting and crushing of the sugarcane for effective planning and control in cooperative sugar industries.

PROBLEM

The basic problem of sugarcane harvesting is that the harvesting of the sugarcane should do in time. The growth of sugarcane is not stable it changes from time to time depending upon the climatic changes sometimes excess of sugarcane production and sometimes shortage of sugarcane in 2-3 years the sugarcane, both affect the operation of sugar factories. If the sugarcane of members of sugar factory is not harvested in the crushing season the sugar factory has to pay the penalty or compensation to the members, in both the cases the

sugarcane grower is the real sufferer. The working of traditional system is based on the records collected from the growers with regard to the date of cultivation date and the alphabetical name of sugarcane growers on the record of the factory. The system functions according to the date of cultivation also to the name of the sugarcane grower taken alphabetically from a-z and the next year vise-a-versa. The sugarcane growers whose names are in between the alphabets a- z are suffering as per both records while arranging from a- z and z-a. When there is shortage of sugarcane preference is given to the sugarcane which is not on the record of the factory.

No single system shows the date on which the sugarcane was harvested. These can be affected by nature road and other facilities required for harvesting of sugarcane. On the side of the sugar factory the factory could not give information about what are the different quartiles that can show that how much of the sugarcane is been harvested of the members. The factory doesn't know how to prepare and maintain region wise records to be used for proper planning and even harvesting.

The problem is studied by the researcher and a mathematical model is being prepared so that it shows the use of significance of quartiles in giving percentage of sugarcane harvesting of the members of the factory.

RESEARCH METHODOLOGY

The scope of the study was kept limited by the researcher to MSSK ltd Sivnagar Tal Baramati Dist –Pune for the crushing season 2010-11. The data has been collected from the sugar factory agricultural department and from the farmers producing sugarcane. The secondary data has been collected from the records of the sugar factory and the various journals, newspapers and through internet.

The sampling technique used as stratified random sampling of The Malegaon Sahakari Sakhar Karkhana Malegaon Tal Baramati Dist Pune has been taken for the crushing season 2010-11.

Notation and Terms

In general , it may be necessary to divide the data into equal parts is called partitioning. Here we are interested in partitioning in four equal parts on the basis of actual capacity of crushing of sugar factory.

Let N = number of days of crushing in a season.

C = Actual capacity of crushing in season

Here,

1. Within $N/4$ days sugar factory has to crush $C/4$ ton of sugarcane say 1st quarter (Q_1)
2. Within $N/2$ days sugar factory has to crush $C/2$ ton sugarcane say 2nd quarter (Q_2)
3. Within $3N/4$ days sugar factory has to crush $3C/3$ ton sugarcane say 3rd quarter (Q_3)

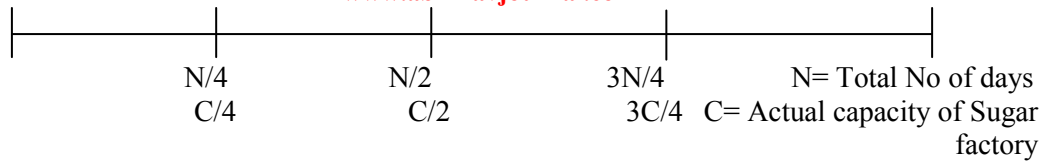


Fig 1. Actual crushing in quarters

Implementation of Quartiles:

Aim of the study is to prove that the harvesting of sugar cane may be equally done for each *gat* proportionally. In traditional method of harvesting program, it may happen that one of the *gats* may not get proper representation for harvesting of sugar cane. In a new method researcher suggest the first estimate, what is expected harvesting capacity of sugar cane in a specific season. The expected harvesting of sugar cane for each *gat* is calculated proportionally as shown below taking into account the possible capacity of the sugar factory :

Table 1. Gatwise availability and expected sugarcane for harvesting in season 2010-11

| Gat No | Gat Name | Available sugar cane for harvesting (in ton) | Expected harvesting sugar cane (in ton) |
|--------|------------|---|--|
| 01 | Baramati | 3132.84 | 2449.63 |
| 02 | Khandaj | 2199.17 | 1719.57 |
| 03 | Malegaon | 3141.09 | 2456.08 |
| 04 | Nirawaghaj | 3252.49 | 2543.18 |
| 05 | Pandare | 3881.09 | 3034.17 |
| 06 | Sangvi | 2664.54 | 2083.45 |

Now arrange the expected sugar cane for harvesting values in increasing order of date of cultivation and alphabetical order of the members. Calculate the actual crushing of sugar in three quartiles say Q_1, Q_2, Q_3 at the time of actual process of harvesting of sugar cane. Now we can compare actual and expected crushing of sugarcane in three quartiles.

In the 1st quarter sugar factory is expecting to crush sugarcane sat ' $C/4$ tons'. Suppose the actual crushing of sugarcane in the 1st quarter is C_1 .

If ($C_1 < C/4$)

Then crushing of sugarcane is not going as per schedule of 1st quarter. We have to improve the efficiency in the 2nd quarter for achieving the target crushing.

And if in the 2nd quarter sugar factory is expecting to crush sugarcane sat ' $C/2$ tons'. Suppose the actual crushing of sugarcane in the 2nd quarter is C_2 .

If ($C_2 < C/4$)

Then crushing of sugarcane is also not going as per schedule of 2nd quarter. We have to improve the efficiency in the 3rd quarter for achieving the target crushing.

For 3rd quarter expected crushing capacity is $3C/4$. Suppose actual crushing of sugarcane in 3rd quarter is C_3 .

If $C_3 < 3C/4$

Then crushing of sugarcane is not working as per schedule of 3rd quarter. Now the sugar factory has to take decision in advance to convey the message to the members of sugar factory and non members that they are unable to crush their sugarcane.

Model Development

The model was developed on the scale of a particular sugar factory and the area of operation supplying sugarcane. The Malegaon Sahakari Sakhar Karkhana Ltd (MSSK) was chosen for the study for the crushing year 2010-11, the model for was been developed by understanding the problem stated above using Decision Support System and stational formula developed for the specific problem of MSSK.

Information Collection

Information about the various system of harvesting currently used in the sugar industry in India was compiled from background readings and discussions with the agricultural officers of MSSK Ltd as well as from interviews with various peoples working in MSSK. A number of other farmers in the area of operation also be interviewed to collect data on operating times for various field process and tonnage of sugarcane on various systems.

Model Structure

The model structure is prepared and Design model for Harvesting of the sugarcane of the sugar factory is done by using a computer sired Decision Support System. The model is so prepared by using statistical formula based on the sample data collected by different gats of the sugar factory. The data is analyzed and used in the model so that the model shows the excess of cultivation in the excess of sugarcane period. Where the sugarcane growers are placed in the red bands so that the agriculture department can know who are the sugarcane growers that we cannot crush their sugarcane in the particular season so that the decision based on the Decision support system shows the alternative for the crushing of the excess of the sugarcane. The sugarcane may either move towards the other factory or they have to give the reimbursement for none crushing of the sugarcane. The problem faced by many factories can be solved if the exact figure of crushing of total sugarcane can be known in advance so that we can make a concrete planning of the crushing season.

Based on the data entered in the decision support system the data is analyzed using the statistical formula and the form is prepared which gives us result of the farmers where the sugarcane is excess in particular season.

The models is so prepared which will give the idea of how much crushing is expected in each quarter and manage the total crushing of the season in advance before the end of season, which will help in homogenous planning of all the activities related to harvesting and actual crushing of the sugarcane in the crushing season.



Fig 2. Samples entry for harvesting schedule

The List of the farmers and the details of the area have been generated by the Decision Support System software by selecting the parameters given in the software screen the user has to select the session year and the method of sorting alphabetical either ascending or descending order of the farmers.

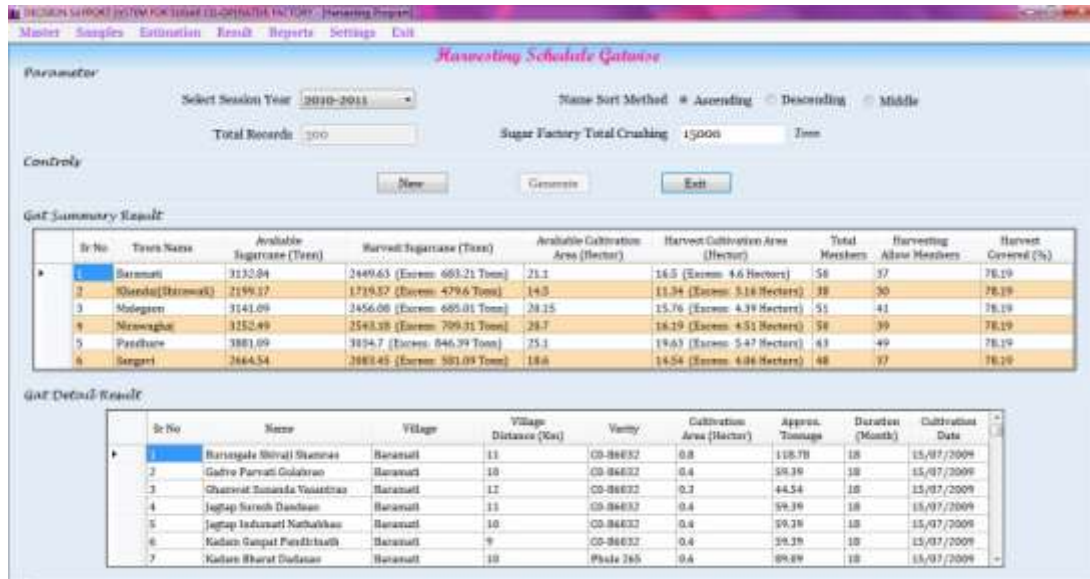


Fig 3. Estimation of harvesting schedule for excess sugarcane

The farmers are arranged in the alphabetical order in accordance with the date of cultivation and name of the farmer. The new system has been adopted by the researcher and been implemented in the factory which starts in the middle of the alphabetical series a- z and goes

in both the side of the alphabetical order which gives the justice to the shareholders whose name are between a-z alphabets. The crushing capacity is checked then the control is given on a new record . When the user clicks on generate the crushing capacity is checked and the list is generated of those farmers according to different gats and the list of red band is included that those farmers who are not covered in those crushing season.. The software gives the percentage of the farmers who are not covered in the crushing season in the different gats. The gats total sugarcane average is multiplied by the area and the approximate average tonnage of sugarcane in the specific gat is calculated. The total gats sugarcane tonnage gives the total cultivation of tonnage in the area of operation of the sugarcane factory

The decision support system model gives the insight into picture that shows what is the real requirement of sugarcane in the particular season. Vice a- versa the sugarcane which is less in that particular season the software gives a clear picture about what will the number of sugarcane tons that should procured the sugarcane in the nearby area which is less for crushing.

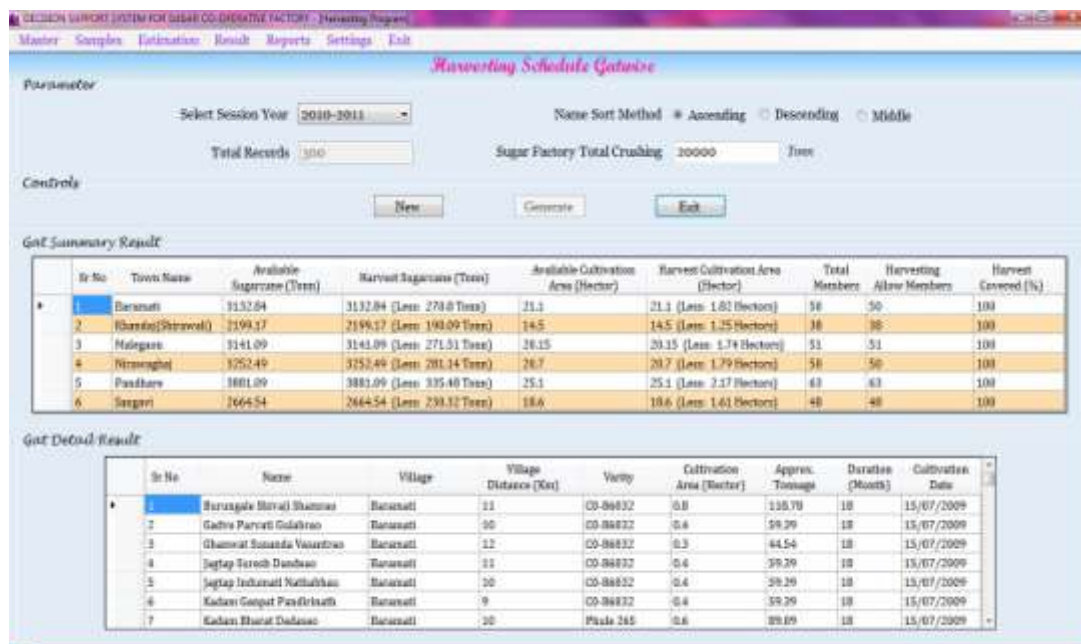


Fig 4. Estimation of harvesting schedule for less sugarcane

The sugarcane which is brought from the sugarcane and the planning which is in the quartiles that how much sugarcane should be harvested in the three quartiles has been planned by the system which will help in planning for better management of workers and value chain of the sugar factory.

CONCLUSION

If actual quartile is less than expected quartile then schedule are not properly maintained then we can suggest various plan of actions like:

1. Reasons behind the slow down which can be eliminated for further scheduling.

2. Increase capacity or efficiency of crushing for further scheduling.
3. Pre intimation to farmers after Q₃ (3rd quartile) for unable their crushing sugar cane.

SUMMARY AND RECOMMENDATIONS

- Right time to start the crushing season is also important for timely harvesting of the sugarcane which will reduce the cost of production cycle.
- Maturated sugarcane of good variety which has more recovery should be selected for plantation and harvesting should be done as hand to mouth for crushing.
- The new system will give justice to the sugarcane growers who are not been covered in the previous system which will help to timely harvesting of the sugarcane.
- The system shows both the excess of sugarcane in the crushing season and the shortage of sugarcane in the crushing season this will improve in proper utilization of resources which will be cost effective to the sugar factory.

ACKNOWLEDGEMENT

We acknowledge sincere thanks to the agriculture department of the MSSK and Chairman, BOD and MD of MSSSK for immense help for giving valuable data from the sugar factory I express special thanks to Dr. Shaligram University of Pune for guiding this paper.

REFERENCES

1. A Directory Indian Sugar Industry, Bhartiya Sugar, 1983-83, Pune(India) P.13.
2. Agarwal R.N., Sugar Industry in India. My Recollections, Popular Prakashan Private Ltd., First Edition, Bombay (India) 1976, P.199
3. Annual Sugar report .Department of food and public distribution govt of India <http://fcamin.nic.in/Annual%20Report/Annual%20Report%20200910%20.pdf>. Accessed on oct 28, 2011
4. C Muthaiya , "Recent trends and outlook in international sugar industry", Indian journal of marketing, 41, 2011, pp 15-22.
5. Donald Shay, The Life of Lord Curzon, 1928, Vol II, P.295, Ernest Benn Ltd., London
6. Indian Sugar Industry at Glance http://www.vsisugar.com/india/statistics/world_indiasugar.htm#http://www.vsisugar.org Accessed on oct 25, 2011
7. Kullapurak Perwthangnam., et.al .,"Application of Crop simulation and mathematical modeling to supply chain management in Thai Sugar Industry", Agricultural Systems, 2009, pp 56-58.
8. Pisal D T and Dr. Ajaykumar , "Operational losses in sugar cooperative factories during sugar manufacturing process in pune district" , Applied research and development institute journal, 2,2011 pp -09-23.
9. Sugar India 2011 year book, anekant prakashan vol iv pp 82-96
10. Thornett.A.M(2001) 'Computer decision support systems in general practice'. International Journal of Information Management Vol 21 pp 39-47

11. Neol Deer, "History of Sugar", Chapman and Hall ltd 1949, pp 15.
12. World Sugar market <http://www.indiansugar.com/briefings/wsm.htm> Accessed on oct 12, 2011