DEVELOPMENT OF THAI SONG SERM SUGARCANE PRIVATE LOADING STATION NONSA-AT DISTRICT UDOTHANI PROVINCE

Dawinee Sukthana [1]
Kanchana Sethanan [2]

[1] *A graduate student in Master of Business Administration Program, College of Graduate Study in Management, Khon Kaen University, E-mail: dawinee08@gmail.com*
[2] *Associate Professor, Industrial Engineering Faculty, Khon Kaen University*

Abstract

This study is aimed at finding solutions to efficiently manage private loading station and to reduce the sugarcane weight loss. The study compared the differences of sugarcane weight that placed on the ground and the cement floor. The study tested the hypothesis by Independent t-test. The result indicated that the average loss of sugarcane's weight placed on the cement floor is more than the average loss of sugarcane's weight placed on the ground with a significance level of α=0.05. From the statistical analysis, the difference in weight of sugarcane placed on the ground or cement floor at different times reported that the average weight of the sugarcane in 09:00 is more than the average weight of sugarcane in 13:00 and, the average weight of sugarcane during the 17:00 is minimum. In addition, results from an analysis of the circumstances of the sugarcane placed on the ground and the cement floor that have different advantages and disadvantages leading to offer the suggestion and decision making for improving the management of sugarcane private loading station. The first approach uses a sugarcane watering system before the weather is hot, which helps to maintain weight for up to 11.92 baht per ton of sugarcane. The second approach is to organize a yard layout, which allows sugarcane placed on the cement floor, facing up to 637 piles and placed on the ground up to 400 piles. Finally, the third approach is to sequence the import and export of sugarcane yard bought into it right away (First in First out: FIFO), which helps reduce the loss of sugarcane weight in sugarcane private loading station and a turnover of sugarcane that come in and out at times.

Keywords: Sugarcane; Private loading station; Development

Introduction

Thailand is the second largest exporter of sugar in the world after Brazil. Thailand also has a chance to become the largest exporter due to the sugar market is expanding every year. However, there are many constrains such as limited of agriculture areas, labor, factory capacity, and oil price which make this business very competitive especially in the transportation that hold the large part of the cost. Because the increasing of the small farmer who has less than 10 Rai by 80% of the overall farmer [1]. They are the farmers who have less capital and some do not have the truck to transport the crops [2]. More importantly they do not have the contact with the factory. Normally when famers want to send their crop to the factory they have to sign contact with the factory but only the medium and large famer who can make contact with the factory because they have more resource in both term, crop and transportation. So, small farmers who do not have their own truck and the farm locate far from the factory might not be cost effective to hire trucks to transport their crops to the factory.

The solution to that problem is to send their crops to the loading station which has 2 types, loading station by the factory and the private one. The loading station by the factory has some benefit such as proportional return rate 70:30 but the waiting time at the station is long and the farmer will not receive cash immediately that directly affect the small farmer because they have to have that money to pay for labor cost or fuel cost. On the other hand the private loading station they pay the famer in cash immediately which the benefit that the private loading station has over the one from the factory. The problem in private loading station is that the management of logistic is not that effective, sometime the sugarcanes stay in the yard for too long and that make the sugarcanes loss weight overtime. According to that it can make the owner of the loading station losses money until this type of business is not cost effective anymore and it has to close. That will damage the small farmer.

According to the problem of the logistic of the loading station, having a better management is an appropriate way to improve the efficiency as reported in research work of Khamjan et al. [3] and Neungmatcha et al. [4] that proposed the method to determine the proper loading station's locations and sugarcane field allocation to minimize the logistics cost. However, the loss of weight of sugarcane during the waiting time in loading station has not been considered in the aforementioned references before. Therefore, this study is aimed at finding solutions to efficiently manage private loading station in Non Sa-at district, Udon Thani province and to reduce the sugarcane weight loss. The proposed method is focus on improving internal private loading station business, since this way is easy to implement because these are the outside parameter that can change easily such as arrange time for farmer to send their crops into the loading station or request the factory to manage a better queuing system. Those can result to prevent or reduce the loss of weight of sugarcane during the waiting time. Another solution that might help is to do a layout planning when the farmer out their crops on the ground to help circulate the sugarcane or First-in-First-out. These can make both the farmer and the station owner can have a sustainable and effective business.

Objective

1. To efficiently manage sugarcane loading station and prevent weight losses.
2. To compare the weight of sugarcane in different time and between on the soil and concrete ground.
3. To minimized the cost to buy sugarcane at the station and the weight that loss during the waiting time.

Methodology

1. Location: Thai Song Serm's yard in Non sa-at, Udonthani
2. Target group and population: there are two ways to stock sugarcane in the yard. First, put them on the soil ground and second is on the concrete ground. The harvest season year 2014/2015 start from 1st December 2014 to 30th April 2015. The sample was collected by no-probability sampling with purposive sampling [5]. The samples are the sugarcane that on the soil ground and concrete ground during 1st December 2014 to 30th December 2014, 6 piles of sugarcane per day, 3 piles of sugarcane from the soil ground and the other 3 from the concrete ground. More importantly during that time is the time that have huge amount of sugarcane inbound to the yard and the weather is quite dry which result to the decrease of the sugarcane weight according to this variable [6]

2.1 Independent variables are pile of sugarcane on the soil and concrete ground.

2.2 Dependent variable is the measured weight of the sugarcane

3. The tools used are 2 types

3.1 Equipment and tool to collect data are the area to store sugarcane, check sheet, industry scale, and agriculture stacker.

3.2 Analysis tool is SPSS 19.0 for Windows

4. Data collecting

In this process, the pile of sugarcane will be selected daily and the compare the weight between pile that on the soil and on the concrete ground. The process need to be done 31 days consecutively which weigh the pile of sugarcane three times per day.

- Round 1 (09:00 AM) weigh the inbound sugarcane before put on the ground
- Round 2 (01:00 PM) weigh the sugarcane second time after put on the ground for 4 hours
- Round 3 (05:00 PM) weigh the sugarcane second time after put on the ground for 8 hours

5. Analyzing is divided into 2 parts
   - Descriptive statistics analysis
   - Measure of central tendency or in other word mean
   - Measure of Dispersion or Standard deviation
   - Hypothesis testing
   - First: defined H_0 and H_1 and always stand in the opposite side
   - Second: Level of significant, α

- Third: test the hypothesis, find the critical point to deny H_0 that correlated to H_0 and α
- Fourth: calculation the statistic from the sample n
- Fifth: accept or deny H_0 by consider if the result from the fourth fall into acceptance area then H_0 will be accepted and vice versa
- Plan to improve the process in purchase sugarcane

Result

The results from the study are three parts, statistical difference of the weight between the sugarcane the store on the soil and concrete ground, analysis the difference of the weight of the sugarcane in three different period of time, and analysis of the weight of the sugarcane that store on the concrete ground that loss overtime. The result will be used to make a decision to construct a plan to improve the management of loading station

statistical difference of the weight between the sugarcane the store on the soil and concrete ground

Hypothesis $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 > \mu_2$

When μ_1 and μ_2 are the average weight loss of the sugarcane on the concrete and soil ground respectively

The independent t-test was used

Hypothesis testing of the weight loss of the sugarcane on the concrete and soil ground between 9AM and 5PM found that F has no statistical significant (Sig > 0.05) and the value of t that used is 2.395, df=184, Sig=0.004 (2-tailed). Due to the one sided test so Sig=0.004/2 = 0.002 (1-tailed) which less than α (0.05) that can concludeas deny the H_0 and accept $H_1 : \mu_1 > \mu_2$. See Table 1.

Timer	Weight loss of The sugarcane on the concrete ground	Weight loss of The sugarcane on the soil ground	hypothesis
9AM and 1PM	greater	-	Accept H_1
1PM and 5PM	Equal	Equal	Accept H_0
9AM and 5PM	Greater	-	Accept H_1

Table 1. Weight loss in 3 different period of time.

Analysis the difference of the weight of the sugarcane in three different period of time

Hypothesis $H_0 : \mu_{before} = \mu_{after}$ and $H_1 : \mu_{before} > \mu_{after}$

When μ_{before} is the average weight of the sugarcane the period of time before.

μ_{after} is the average weight of the sugarcane the period of time after.

Paired-sample t-test was used

The time between 9AM and 5PM, hypothesis testing of the sugarcane on the soil ground with t-test, the t value is 19.958, df=92 and Sig=0.000 (2-tailed) but only one side is needed so Sig=0.000/2=0.000 (1-tailed) which less than 0.05. So H_0 was denied and accept H_1, H_1, $H_1 : \mu_{before} > \mu_{after}$. See Table 2.

Comparison	Period 1 (Before)	Period (After)	Hypothesis
1	9AM	1PM	Accept H_1
Result	Greater	Lower	
2	1PM	5PM	Accept H_1
Result	Greater	Lower	
3	5PM	5PM	Accept H_1
Result	Greater	Lower	

Table 2. Comparison of the weight of the sugarcane on the soil ground in 3 different period of time.

3. Analysis of the weight of the sugarcane that store on the concrete ground that loss overtime.

The results are all in the same direction to the analysis the difference of the weight of the sugarcane in three different period of times that is accept H_1 in all cases

4. The guideline to support the management of the loading station

Guideline 1: Sprinkle water before the hot period

1. Operating

Pump up the groundwater into the tank on the truck, 8000 liters capacity

Supply water to the moveable sprinkles in 5 meters space

Sprinkle the water during 10AM to 11AM, the period that the sugarcane affect by the sun the most

2. Budget

Groundwater cost 1200 Thai Baht per 3 month or 400 Thai Baht per month

Electricity to pump 1000 liters groundwater to the tank around 20 Thai Baht per 1 times (5 minutes per time)

Fuel cost to move the water in the yard 10-15 Thai Baht per time

Sprinkle cost 100 Thai Baht, 5 Sprinkles equal to 500 Thai Baht

PVC pipe cost 10 Thai Baht per meter, 20 meters is used and equal to 200 Thai Baht

3. The expected result

If the cost of the sugarcane were 1000 Thai Baht per ton or 1 Thai Baht per kilogram then this model should get profit from selling the prevented loss weight sugarcane by 11.92 Thai Baht per ton

Guideline 2: Management of layout of the yard

1. Operating

Clearly define the area to dump the sugarcane, 150 centimeters apart and 200 centimeters apart if in the same roll

2. Budget

Cost of the sign 2 Thai Baht per item

3. The expected result

If the plan works then the yard can store the pile of sugarcane up to 637 piles and 400 piles on the concrete and soil ground respectively.

Guideline 3: Inbound and outbound management (First-in-First-out)

1. Operating

Based on the sign of the location to dump the sugarcane then it could be known that which one come first and cone later. This can help to implement the First-in-First-out. See Figure2

2. Budget

No need to pay because it is the adapt of the ideal

3. The expected result

Reduce the loss of the weight of the sugarcane and help circulate the sugarcane to have the better time interval

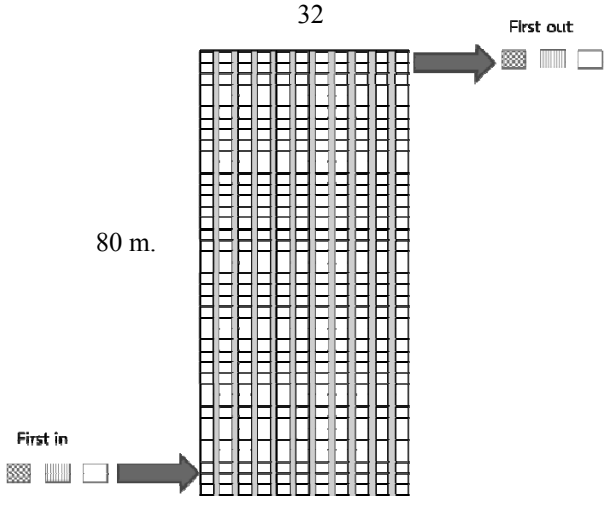

Figure 1 Layout and First-in-First-out

Conclusion

Base on the study to efficiently manage sugarcane yard which focus on the weight that loss during the waiting time between on the soil ground and concrete ground. And the target group is the pile of sugarcane on both soil ground and concrete ground from 1st December

2014 to 31th December 2014. The result from the study based on the hypothesis testing using independent t-test to find the different between the pile of sugarcane that put on the soil ground and concrete ground show that the mean of the weight from the concrete ground is higher than the mean of the weight from the soil ground significantly by 0.05. In addition the mean of the weight from different time of day, 9 AM, 1 PM, and 5PM, using paired t-test found that the mean from 9 AM is greater than the mean from 1 PM and the mean from 5 PM is the lowest. However, there are advantage and disadvantage in putting the sugarcane on each ground which suggest that the type of the ground plays an important role to the result and also lead to guidelines to improve the management of the sugarcane loading yard. First, sprinkle water over the sugarcane in the hottest period according to the previous result which can preserve the weight by 11.92 Thai Baht per ton. Second, layout planning of the yard can increase the amount of pile of sugarcane on the soil and concrete ground to 637 piles and 400 piles respectively. Lastly, implement First-in-First-out to reduce the chance of losing weight of the sugarcane that come first. More importantly in order to improve the management of the sugarcane, those three guideline should be used because they are probably the cheapest way to improve the efficiency of the management and together with the help of the owner of the yard and the farmer they have to work to together to get the result they want.

Recommendation

Simulation should be done to manage the area to store the sugarcane from the small famer and to forecast the time when they are coming to the yard.

Information technology and data base management should be implemented in the future.

Acknowledgement

I was able to successfully complete this independent study with the kind assistance and support of my advisor, Associate Professor Kanchana Sethanan, Ph.D., and all instructors. I would like to take this opportunity to thank each and every one for providing me with helpful guidance and suggestions along the course of this study.

References

[1] Singh, G., Pathak, B. K. (1994). A decision support system for mechanical harvesting and transportation of sugarcane in Thailand. Computers and Electronics in Agriculture. 11(2-3), 173-182.

[2] Sethanan, K., Chetchotsak, D., Bureerat, S., Tongsokhowong, A., Chancharat, S., Boonmee, A., Chaikanha, N. (2012) Supply chain redesign for sugarcane industries in preparation for the AEC framework. The Thailand research fund, Program on Industry

[3] Khamjan, W., Khamjan, S., & Pathumnakul, S. (2013). Determination of the locations and capacities of sugar cane loading stations in Thailand. Computers & Industrial Engineering, 66, 663–674.

[4] Neungmatcha, W., Sethanan, K., Gen, M., & Theerakulpisut, S. (2013). Adaptive genetic algorithm for solving sugarcane loading stations with multi-facility services problem. Computers and Electronics in Agriculture, 98, 85–99.

[5] Vanichbuncha, K. (1999). Statistical analysis: Statistics for management and research. (4th ed.) Bangkok: Chulalongkorn University Printing House.

[6] Boontum, A. (2002). The production of sugarcane and sugar. Thai Sugar Millers Corporation Limited. 8(3)2-3.