The Reason why we can't use Cassava leaf for Commercial Purpose in Thailand.

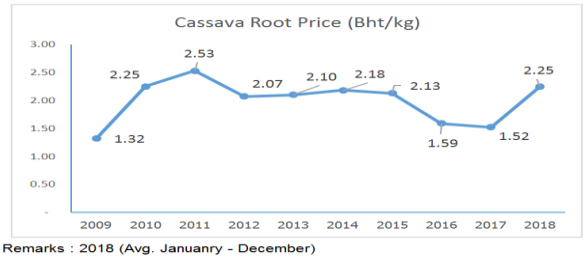
Supattra Buasaengchan, Somchai Pengprecha, Pakpachong Vadhanasin, Kriengkri Kaewtrakulpong

Abstract*— Cassava Leaf has the major high content of crude protein for animal feed under the study for more than 20 years. The question for this research study is why we cannot use cassava leaf for the commercial purpose in Thailand, the leader of cassava export of the world. The estimated results of this task are that we can increase income of the farmers not less than 450 million baht or 14 million U.S.dollars per year at only 10% of the total usage and we can reduce the import of crude protein raw materials such as fish meal and soybean meal. This research proposed is to study the cassava and cassava leaf supply chain, the factors influenced in cassava leaf harvesting and transportation in order to find the innovation process that can sustain the cassava farmer's life and cassava sustainable agriculture. A field survey, interviews and questionnaires were performed to comprehend and accumulate information for analyzing. The study separates in the fundamental factors and the factors effect decision making. Just 16% of the farmers interest in cassava leaf selling. The study shows the interesting points of reason for not selling. One of the important reason is the waste in time and labor so the farmers think it's not worth to cut it. The results of the study will be the major factors concerned to develop the innovation process in order to find the possible solution to bring cassava leaf to the animal feed industry.

***Index Terms*—Cassava Leaf, Cassava Leaf Harvest, Cassava Leaf Supply Chain, Sustainable Agriculture**

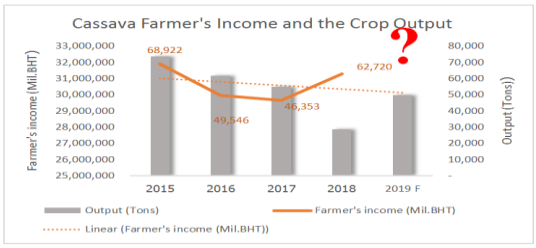
I. INTRODUCTION

Cassava is the economic plants ranked the 3rd agriculture exporting products of Thailand, the price of the cassava is fluctuated from 1.52 to 2.53 baht per kg. during 2009-2018 (Office of Agricultural Economics, 2018) (Fig.1)which effects the farmer's income. Although Thailand has 8.4 million Rai (1.344 million Hectare - 1 Hectare = 6.25 Rai) of cassava harvesting area in year 2019, the forecast of cassava farmer's 2019 income in *Fig.2* shows the trend to decrease.



Source: Office of Agricultural Economics, 2018

Fig.1 Cassava Root Price (Bht/kg)



Source: Office of Agricultural Economics, 2018

Fig.2 Cassava Farmer's Income and the Crop Output

From over 20 years of researches in Thailand show the strong point of cassava leaf for feed meal which contain 20-32% of crude protein and various essential amino acids in the same percentage of soybean meal. (Achara Limsila et al., 2002). For the ruminant, the cassava leaves can increase milk yield with protein and fat together with increase thiocyanate content that can preserve the quality of milk in transit. (Sukanya Jattupornpong et al., 2005) Moreover, hydrocyanic acid and tannin-protein complexes at the suitable level from the dried cassava leaf can increase immunity and be rumen by–pass protein for digestion in the small intestine and reduce gastrointestinal nematodes in ruminant. (Metha Wanapat, 2001).

Comparing price to percent of crude protein (CP)in *Fig. 3*, dried cassava leaf has the competitive price per % CP at 0.36 comparing to soybean seeds at 0.33 baht per one percent of protein. (Thai Feed Mill Association, 2017 and Bureau of Nutrition Development, 2016)

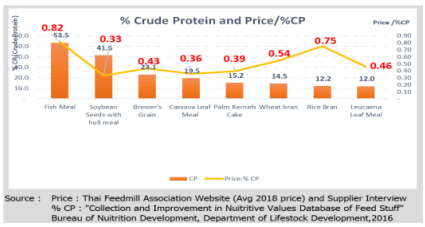


Fig.3 Percent of Crude Protein and Price/Percent CP

Although cassava leaves is very good ingredient for animal feed, there are not enough cassava leaf supply for the feed industry. The estimated results of this task are that we can increase the income of the farmers for not less than 450 million bahts or 14 million U.S.dollars per year at only 10% of the total usage of cassava leaves and the import of crude protein raw materials such as fish meal and soybean meal can be reduced. ***The question why we cannot use cassava leaf for the commercial purpose in Thailand*** is the starting point for this study.

Revised Manuscript Received on May 29, 2019.

Supattra Buasaengchan, Technopreneurship and Innovation Management, Graduate School, Chulalongkorn University (sbushindan@yahoo.com)

Somchai Pengprecha, Faculty of Science, Chulalongkorn University (somchai.pe@chula.ac.th)

Pakpachong Vadhanasin, Faculty of Commerce and Accountancy, Chulalongkorn University (pakpachong@hotmail.com)

Kriengkri Kaewtrakulpong, Faculty of Agriculture, Kasetsart University. (agrkkk@ku.ac.th)

1.1 Objectives of Study

This research is to study the cassava and cassava leaf supply chain, the factors influenced in cassava leaf harvesting and transportation in order to develop the innovation process that can sustain the cassava farmer's life and cassava sustainable agriculture emphasizing on cassava leaves harvesting and transportation.

1.2 Methodology

1.2.1 Population and sample group of study

The sample of this survey is the 260 cassava farmersfrom 8 provinces, out of 486,193 household of cassava farmers (Department of Agriculture Extension, 2017) in five regions of Thailand and 10 in-depth interview of the existing process and resources person.

1.2.2 Data Collection Method

This research is both quantitative using questionnaire and qualitative by in-depth interview. The questionnaire was developed from the in-depth interview and secondary source of information gathering.

1.2.3 Reliability Assessment

In order to ensure the reliability of the research, Data Triangulation was used for comparison. This process involves in the comparison between the qualitative and the quantitative information from survey. The secondary sources of information are compared to support the reliability.

Content validity of the questionnaire was checked by using Index of Item-Objective Congruence (IOC) with 4 experts which comprise of the cassava farming leader who won Thailand's Best Farmer Award (cassava farming), the technical officer in agriculture support department, and two experts from Bureau of Animal Nutrition Development.

II. RESULTS

2.1 Demographic Information

Sixty one percent of 260 samples answering the questionnaires are male and thirty nine percent are female. The majority of the samples, 72% age more than 40 years.

The major region of the respondent (78.7%) is in the northern region of Thailand. The others are spread on the other regions of Thailand.

2.2 Plantation Information

The major informants (81%) has the plantation in the plain type of land. Thirty one percent plant in the size of 11-20 Rai (1.76-3.20 Hectar). 26% have 21-50 Rai (3.36-8.00 Hectar) and 24% have 5-10 Rai (0.80-1.60 Hectar) (*Fig.4)*

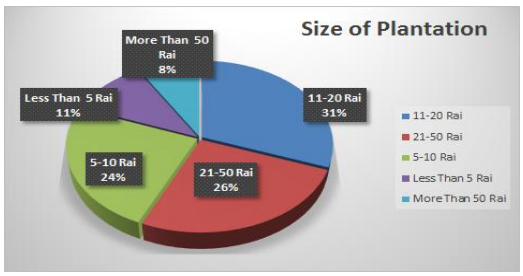


Fig.4 Size of Plantation

Method of plantation in *Fig.5* can be categorized to three ways, plant the cutting in horizontal, vertical and lean. The vertical method is still the major method with 93% result while the horizontal method which has only 2% plantation is the new way of the farmers who want to plant for the leaf harvesting purpose. The lean is 5% as shown in *Fig.5.*

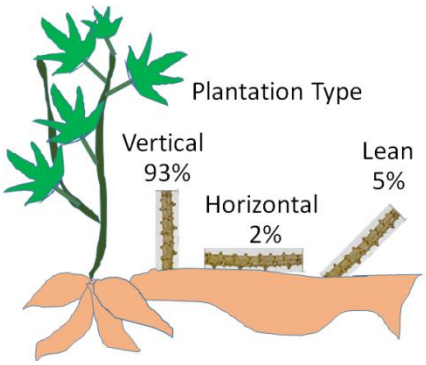


Fig.5 Plantation Type

Size of the bush and height of the trees are the factors for harvesting concerned. The samples show the major size of bush in *Fig.6.* 57% is bigger than 50 cm.

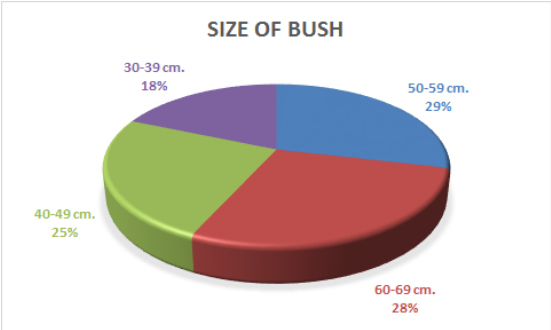


Fig.6 Size of Bush

The planting distance *(Fig.7)* shows both column and row distance. For the column distance, 39% is in the range of 31-60 cm. For the row distance, the samples show the substantial 50% proportion for more than 80 cm.

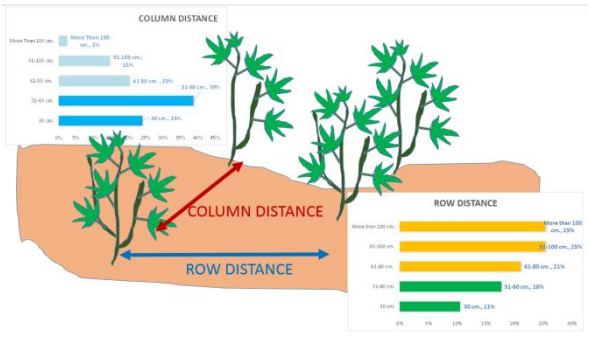


Fig.7 Planting Distance

For the factor of height (*Fig.8*) shows the major result in 151-180 cm. at 30% and 100-120 cm. at 23% which mean that the way of the harvesting innovation tools should collect the leaf at least 100 cm. up to 180 cm. in height.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

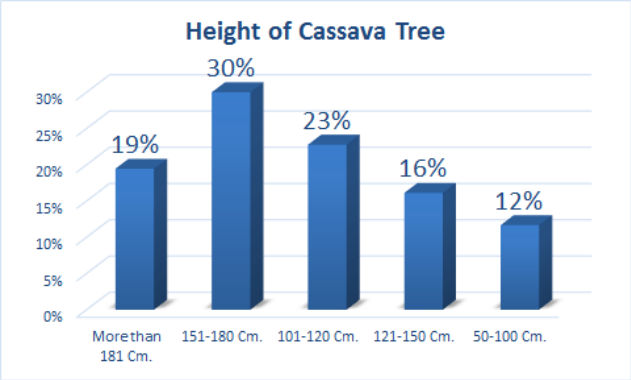


Fig.8 Height of Cassava Tree

Cassava varieties factor from the survey show the major is Huay Bong 80 at 52%, Kasetsart 50 at19%, Rayong 5 at 17%, Kiew Plod Nee 9% and the others at 2%. *(Fig.9)*

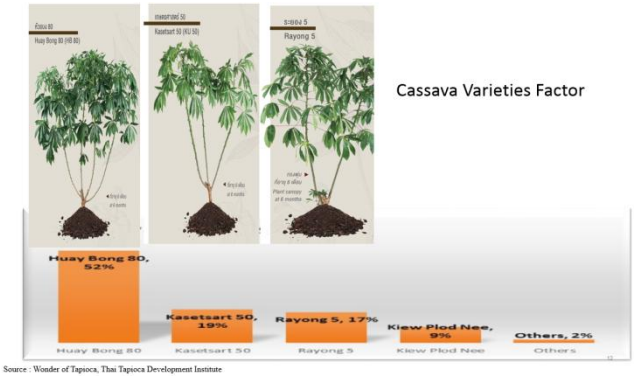


Fig.9 Cassava Varieties Factor

The farmers in the survey show the way to access to their field by vehicles at 93% which divided into 58% by tractor, 19% by pick-up truck and 15% by truck. The rest 7% access to the field by foot (*Fig.10*). It is the good reason for the transportation machine or equipment development.

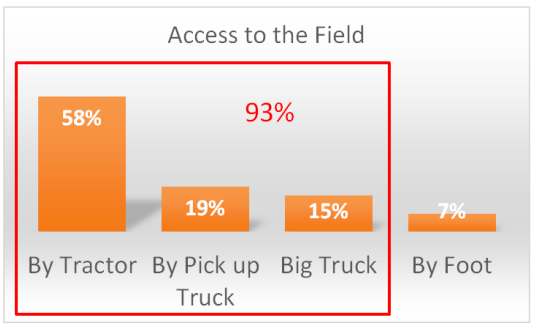


Fig.10 Access to the Field

However, the existing method of plantation use labor intensive at 90%, only 8% of the participants use machine.

2.3 Cassava Usage Supply Chain

The Supply Chain of Cassava, gathering from the in-depth interview and secondary sources, the farmers start from the plantation (normally in the beginning of the rainy season), harvesting the cassava roots at the average age from 8 months up, and send to the cassava collectors who gather cassava root for the factory. The factory either starch factory or cassava chips processing factory processes the cassava root to two major products, cassava chips and cassava starch. These are the intermediate materials for various industries such as food, feed, ethanol and the others as shown in Fig.11.

For cassava leaves usage (*Fig.12)*, 71% of the informants burn the cassava leaves since they think the leaves and the stems remain are difficult to manage. 25% left the leaves in the field to be the natural fertilizer for the next crop and only 4% sale the leaves.

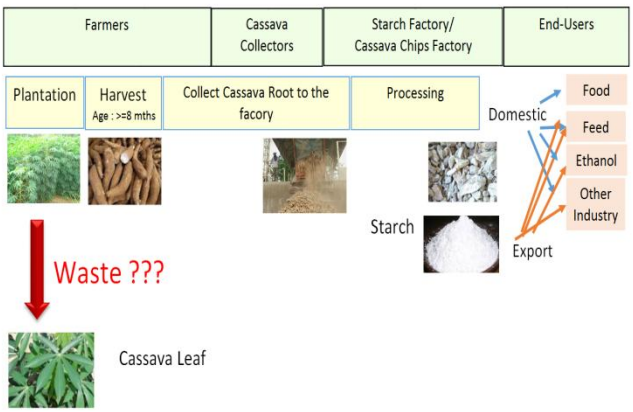


Fig.11 Cassava Supply Chain

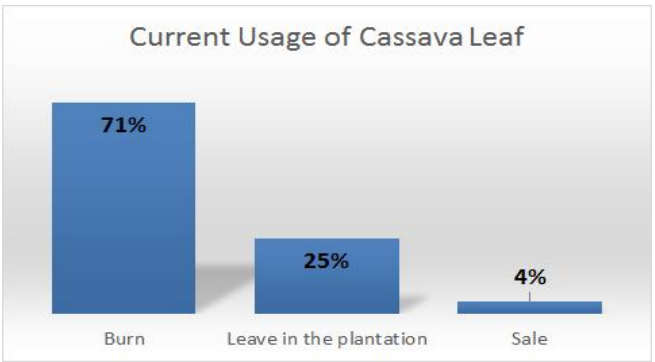


Fig.12 Current Usage of Cassava Leaf

The existing cassava usage supply chain *(Fig.13*) from the survey comprise of 3 types, 1.Cassava root 95% 2.Cassava Root and Cassava Leaf 5% 3. Cassava Leaf, none of the respondent grows cassava for leaf. However, from in-depth interview, we find one farmer who plant the cassava tree for cassava leaf sale only.

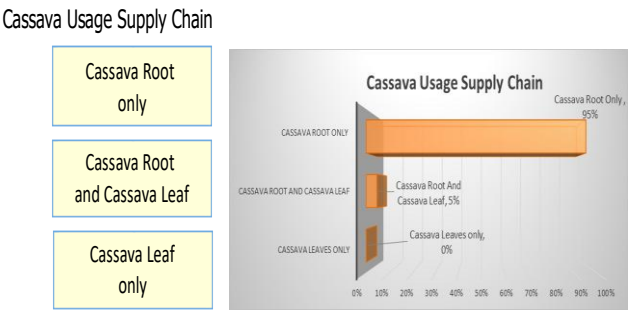


Fig.13 Cassava Usage Supply Chain

2.4 Interest in Cassava Leaves Selling

From the survey, (*Fig.14)* 61% of the participants know the cassava leaf sale information. Only 16% of them are interested in selling. 40% has no interest and 44%are indecisive *(Fig.15).*

Fig.14 Cassava Leaf Sale Information

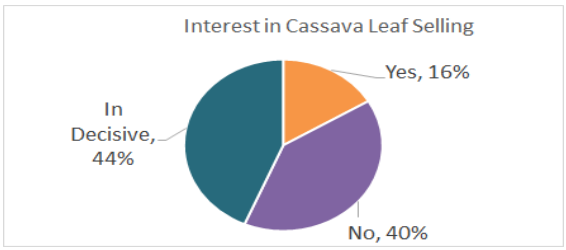


Fig.15 Interest in Cassava Leaf Selling

The major reasons why the participants don't want to sell the leaves *(Fig.16)* comprise of 1.No time (18%), 2.Low Revenue (17%) 3.Not Worth the Investment (17%) 4.Effect to the cassava Root (16%) 5.Lack of Labor (15%) and 6.Need Tooling Support (13%).

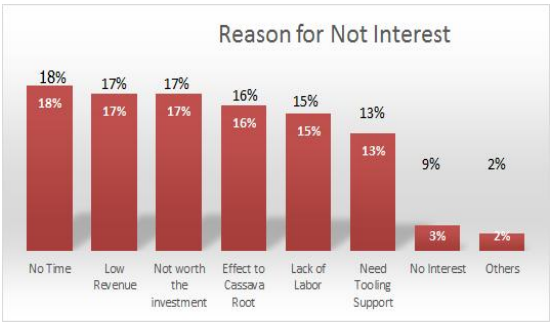


Fig.16 Reason for Not Interest

The estimated price of cassava leaf from the survey shows various price from 0.50 baht to 50 baht per kilogram. The Price of 3.00 baht per kg.is the major price the participants required at 20.9%.*(Fig.17*)

Fig.17 Estimated Price of Cassava Leaf

2.5 Existing Cassava Leaves Harvesting Process and the Factors effect.

The existing Cassava Leaf Harvesting Process *(Fig.18)* from the in-depth interview and the investigation has the major activities which are harvesting, chopping, drying and packing into the bag. Every activity especially the harvesting are labor intensive, it takes time and costly.

The activities of the cassava leaves harvesting are cutting the leaves, moving by labor and transporting to sale. Wastes incurred in all the process since the farmers have to cut the leaves, drop down to the soil and then gather them to the small truck which lessen the quality of the leaves.

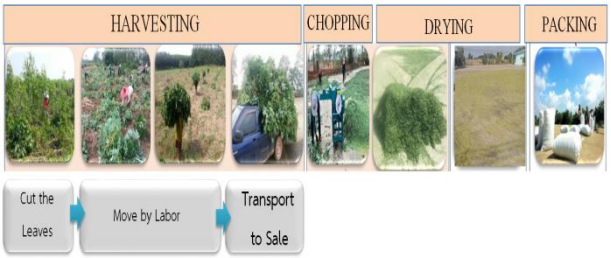


Fig.18 Existing Activities of Cassava Leaves Harvesting Process

2.5.1 Cut the Leaves

The current method of cassava leaf harvesting show significantly (68%) by the knife, and 31% by hand. *(Fig.19)*

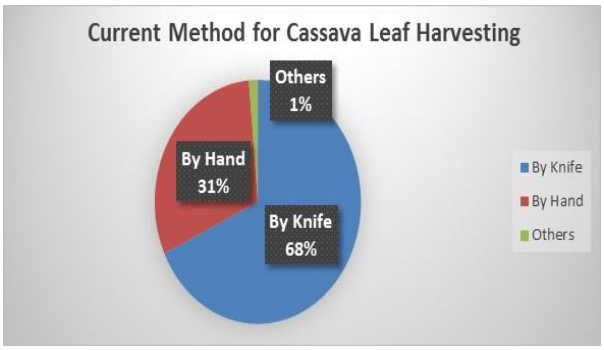


Fig.19 Current Method for Cassava Leaf Harvesting

The number of labor in harvesting are 3-5 person per 1 Rai (0.16 Hectar) at 44% and 1-2 person at 40%. Fifty one percent of labor is daily wage and 48% is operated by the owner and the family. (*Fig.20*)

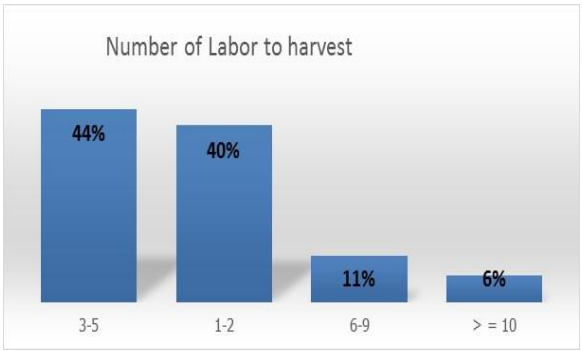


Fig.20 Number of Labor to harvest

Average time usage for harvesting 1 Rai is 4.29 hours. 27% of the participants use 4 hours' time. The longest time used is 12 hours and the shortest time used is 1 hour only. The study needs field survey to check the relevant of time and labor usage. *(Fig.21)*

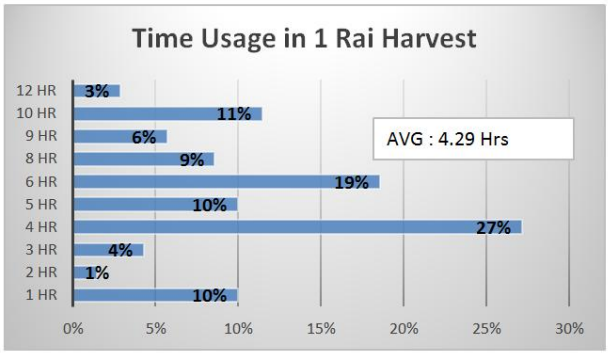


Fig.21 Time Usage in 1 Rai Harvest

The average age of cassava leaves harvesting *(Fig.22)* illustrated that 48% harvest from the age of 12 months up (harvesting for root). Twenty one percent harvest at the age of 8-11 months and 21% harvest the cassava leaf at the age of 4-7 months which is accordingly to the intention to pick the leaves for the trading purpose.

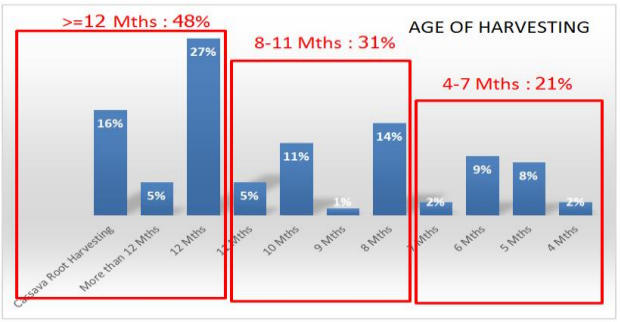


Fig.22 Age of Harvesting

2.5.2 Move by Labor

The current transportation after harvest from the survey shows 82% is in manual transportation to the truck or the car and 13% drive the truck to pick up the leave. *(Fig.23)*

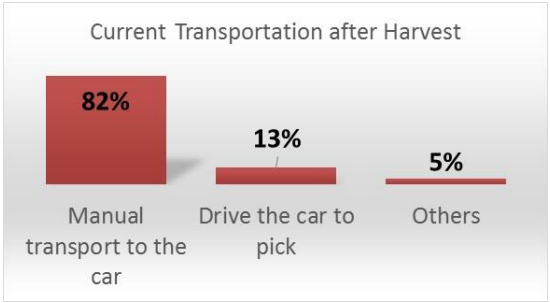


Fig.23 Current Transportation after Harvest

2.5.3 Carry to Sale

The current transportation to sale *(Fig.24)* from the survey indicated that 75% farmers transport to the merchant and 22% the merchant own transportation from the farm.

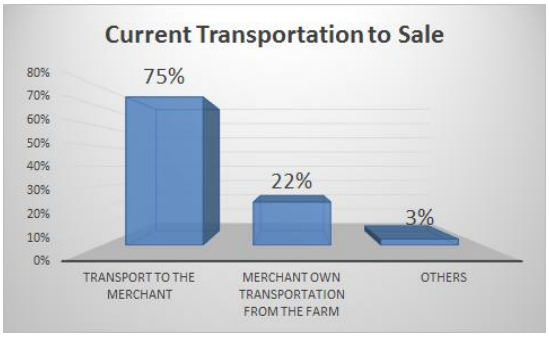


Fig.24 Current Transportation to Sale

The major current vehicle to the merchant is Thai Tractor (E-tan truck) which show 94% of the samples *(Fig.25)*.

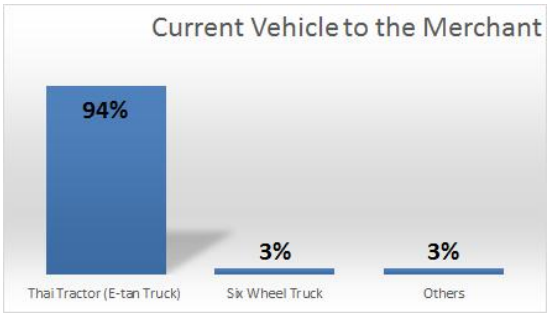


Fig.25 Current Vehicle to the Merchant

2.5.4 Overall of the harvesting

The weight of leaf collected per rai *(Fig.26)* shows the average in 596.6 kgs. 32% of the participants shows weight of leaf at 1,000 kgs per rai.

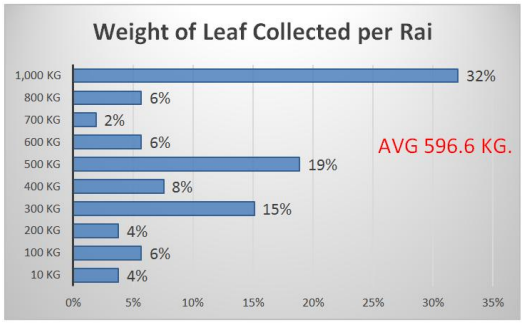


Fig.26 Weight of Leaf Collected per Rai

Cost of leaf harvesting per rai from the survey *(Fig.27)* is 667 baht in average and 25% of the respondents give the information of cost at 1,000 baht.

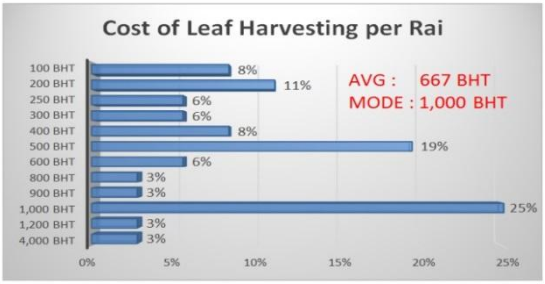


Fig.27 Cost of Leaf Harvesting per Rai

The satisfaction of current harvest *(Fig.28)* 94% are not satisfy for the existing process, just only 4% satisfy with the existing process.

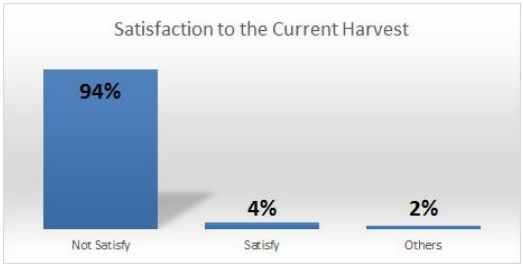


Fig.28 Satisfaction to the Current Harvest

The interest in harvesting tools *(Fig.29)* is one of the questions to ask the participants for the new innovation in order to serve the efficient harvesting. The result shows 75% interest in the harvesting tools. Moreover, the participants provide many ideas to develop the process in harvesting and the expectation which will be the further step of new process development.

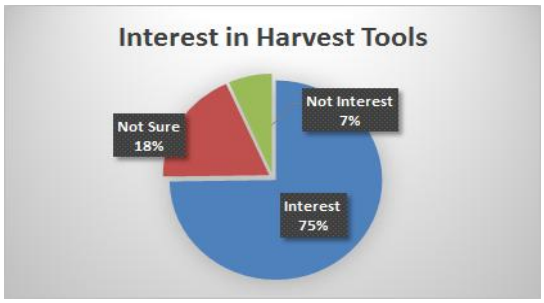


Fig.29 Interest in Harvest Tools

CONCLUSION AND DISCUSSION

3.1 Conclusion from the Result

The results of the study for the major factors concerned in developing the innovation process *(Fig.30)* in order to find the possible innovative solution for the cassava plantation in Thailand to bring cassava leaf to the animal feed industry. Although cassava leaves are very beneficial and can increase the income of the farmers, the study shows not so strong interest in cassava leaf trade due to the labor intensive which effect time usage and cost. One important point to study more is the effect to the output of the cassava root. The information we gained from this survey are very substantial for the researcher to develop the innovation for cassava leaf harvesting and transportation machine based on the information concluded in the following (*Fig.30).*

Resources for Harvesting						
1.Man	Labor Intensive 90%					
2.Machine	No Machine Usage - Just Manual					
3.Raw Material	Major Varieties : Huay Bong 80,Kasetsart 50					
4.Money-Cost	Avg. 667 Bht per Rai					
5.Management	Labor Intensive Base : A lot of waste in process					
Time concerned	4.29 Hrs in average per Rai					
Output : Cassva Leaves	Avg 596.6 kgs per Rai					
Plantation Information						
1.Type of Land Usage	Plain	81%				
2.Size of Plantation	≤ 10 Rai	35%	11-20 Rai	31%	21-50 Rai	26%
3.Plantation Type	Vertical	93%				
4.Planting Distance	31-60 cm	39%	30 cm	24%		
5.Row Distance	≥ 81 cm	50%	61-80 cm	22%		
6.Size of Bush	50-59 cm	29%	60-69 cm	28%	40-45 cm	25%
7.Cassava Varieties	Huay Bong80	52%	Kasetsart 50	19%	Rayong 5	17%
8.Height of Cassava Tree	151-180 cm	30%	101-120 cm	23%	≥ 181 cm	19%
9.Access to Field	By Tractor	58%	Pick p Truck	15%	Big Truck	15%
10.Method of Plantation	Labor	90%	Machine	8%		
11.Age of Harvesting	In the period of Cassava Root Harvesting 8 mths up					

Fig.30 Factors Concerned for the Innovation Process

3.2 Limitation of the Study.

Limitation of this study is that the results majorly based on quantitative survey, the in-depth and field work survey should be add on to comparethe result.

3.3Discussion

From the result, the model will be developed from the primary factors in both qualitative survey and in-depth interview. The innovation model should be the model that can support the cassava leaf harvesting to the commercial way and increase the confidence of the farmers for the total revenue they will earn by reducing the waste time from the labor intensive.

REFERENCES

1. Apinan Jinpala, Cassava Hay and Silage to Mastitis Controls.
2. Atchara Limsila., Saowaree Tungsakul, Peaingpen Sarawat, Watana Watananonta, Atapon Boonsing, Somyot Pichitporn and Reinhardt H.Howeler. Cassava Leaf Production Research in Thailand. Cassava Research and Development in Asia: Exploring New Opportunities for an Ancient Crop. Proceedings of the Seventh Regional Workshop held in Bangkok, Thailand. Oct 28-Nov 1, 2002, Centro International de Agricultural Tropical (CIAT) and the Department of Agriculture (DOA) of Thailand, pp.472-480, Nov. 2002
3. Bureau of Nutrition Development, Collection and Improvement in Nuitritive Values Database of Feed Stuff, Bureau of Nuitrition Development, Department of Lifestock Development, 2016
4. Department of Agriculture Extension, Farmer Map, 2017
5. Metha Wanapat, The Role of Cassava Hay as Animal Feed, Research Gate, 2001
6. Office of Agricultural Economics (2018).Industrial Cassava in 2019 (Plantation Year 2018/2019) http://www.oae.go.th/view/1
7. Sukanya Jattupornpong, Warapan Jintawit. The Usage of Dried Cassava Leaf as Feed, Suwanvajokkasikij Animal Research and Development Institute, Kasetsart University, 2005
8. Thai Feed Mill Association, Feed Price Statistics, 2017
9. http://www.thaifeedmill.com/tabid/78/Default.aspx
10. Thai Tapioca Development Institute, Wonder of Tapioca, 2017

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication