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) which effects the farmer’s income. Although Thailand has 8.4 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.

![Fig.1 Cassava Root Price (Bht/kg)](image)

Source: Office of Agricultural Economics, 2018

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](image)

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.
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 farmers from 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).

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.

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.

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.

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.
Cassava varieties factor from the survey show the major is Huay Bong 80 at 52%, Kasetsart 50 at 19%, Rayong 5 at 17%, Kiew Plod Nee 9% and the others at 2%. (Fig.9)

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.

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.

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.
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](image)

![Fig.15 Interest in Cassava Leaf Selling](image)

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](image)

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](image)

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](image)

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](image)

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](image)
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)

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.

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)

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

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.

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.
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](image)

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](image)

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).

![Fig.30 Factors Concerned for the Innovation Process](image)

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 compare the 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.

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