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Technology transfer of beef cattle raising for productivity improvement based on intensive farming of beef cattle raising group in Pua District, Nan Province

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Abstract Beef cattle have been found to be a significant part of the Thai farmers' lifestyle since ancient times. Knowledge and methods of beef cattle raising were accumulated and passed on from generation to generation until it led to the raising of beef cattle with basic farming management that does not comply with the present principles. The results indicated that the majority of the farmers lack knowledge about beef cattle raising in accordance with the intensive farming practice. Consequently, farmers were required to participate in a one-day training workshop during the month of May 2017. Comparing the knowledge of farmers before and after concerning the technology transfer, the study found that farmers have acquired more knowledge and they would apply the knowledge gained from the training and adapted it for raising beef cattle at the highest level in their own way. The study also found that related departments should assess the readiness of farmers before promoting beef cattle farming based on intensive farming practice. The intensive farming practice included readiness of the farmers, physical and biological readiness among the community, and readiness of market receiving the product should correspondingly be implemented gradually along with the establishment of Learning Network and Business Network among farmers.

Keywords: Beef cattle, Intensive farming, Nan

Introduction

Raising beef cattle have been associated with the agricultural occupation and livestock system of Thai farmers for decades. The main drive of beef cattle farming is used as labor for farming and agriculture. However, the current purpose of beef cattle farming has been transformed to mainly beef raising for beef production due to the increasing demand for both domestic and international beef consumption. Therefore, beef cattle have become very important livestock for the country's economic growth since they have certainly generated income of the farmers. Farmers received support from the government's policy on promoting beef cattle farming as well as it was also one of the projects under the restructuring plan of

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agricultural production system. According to Department of Livestock Development (2012) stated that in the year of 2019, Thailand has produced 1.178 million of beef cattle, increased from 2018 which it produced 1.126 million beef cattle (4.62 percent). As for the tendency in 2020, it is expected to produce 1.249 beef cattle, increased to 6.03 percent in 2020. Accordingly, the production of beef cattle is nearly for all the domestic consumption (Office of Agricultural Economic, 2020a). Farmers preferred to raise native cattle and the percentage of the preference is 56.57 percent of the whole country (Department of Livestock Development, 2020). Hence, beef cattle farmers in Thailand can be divided into 3 categories. The first category is farmers who raise a huge number of beef cattle in farming style with a standardized farming management system. The raising focused on the production of beef for the market purpose only. Farmers in the second category raised beef cattle as their main occupation with a minor number of beef cattle and mainly used family labor. Farmers in the third category raised beef cattle as their additional occupation and raised only a small number of beef cattle. Meanwhile, the latter two groups constitute the largest group of beef cattle farmers in Thailand. They are perceived as a large number of farmers who had no knowledge to operate and managed their beef cattle and their disease prevention was below the standard. Therefore, it resulted to delay adoptation to transfer technology (Simasatitkul *et al.,* 2006).

Nan province is considered to be the third highest number of beef cattle farmers in the upper Northern region after Chiang Mai province and Lampang province. According to the sequent of the data of 2020, the finding found that there were 7,516 beef cattle farmers and 46,383 beef cattle in Nan province (Department of Livestock Development, 2020b). Nan locates in border which closedly to the Democratic Republic of Laos, there was shown more potential to export beef cattle in neighboring countries and it has become the means of transportation to China. Therefore, it was consistent with more demand for live beef cattle sending to the slaughterhouse in China. Thus, it was an opportunity for Thailand to export products and meet the needs of the consumers in the Southwest of China. However, the number of beef cattle in Thailand decreased continuously during these 4 years (2011-2015) and it reduced by 30 percent of the total beef cattle number in the country (Department of Livestock Development, 2011).

Although the number of beef cattle is currently increasing, the increasing proportion is still less than the decreasing proportion. Thus, the problem has occurred and resulted from the insufficient production of beef to meet the needs of all domestic consumers. Similarly, in Nan province, that had been faced the insufficient beef production for the domestic

consumption in its province until it has to import live beef cattle and carcasses which worth over 100 million baht per year (Department of Livestock Development, 2016). Nan's farmers had been experienced in many problems regarding the raising of beef cattle, obstacles and limitations in the development of beef cattle farming for farmers in this area. Nan provincial livestock office (2016) addressed the issues of beef cattle production, especially the native species in Nan province, and divided them into 5 important issues:- (1) applicable understanding used in beef cattle farming regarding the agricultural principles; (2) problems of the breeding species; (3) the shortage of forage crops; (4) disease prevention and control of the spread of diseases; (5) capital and investment. Most of the farmers are crofter and have only a small business resulting in a lack of business liquidity. Relating to the issue that has been mentioned above, the assumption of the main cause of the problems of beef production in Nan province would be considered as "innocent". Therefore, the solution to the problems would begin with the transfer knowledge and technology in raising beef cattle appropriately to the farmers as the first attempt.

The technology transfer of beef cattle farming based on the intensive farming practice which seem to be another alternative to increase the efficiency of beef cattle production for farmers. Accordingly, farmers was required to integrate beef cattle systems by using the technology of raising cattle to be the standardized system as well as relying on a unified system (Office of Regional Livestock, 2014). Consequently, farmers can use the resources in their area valuably as the solution to poverty and have a sustainable career and income based on a balanced ecosystem.

Research finding was to the total number of beef raising farmers (50 members) with approximately 300 beef cattle in Pua district, Nan province (Figure 1). They were a group of farmers from 1 out of 5 in pilot districts in Nan province was selected to be study area which suitable for beef cattle farming in Pua district, Pu Piang district, Boklua district, Santisuk district, and Mae Charim district. The collaboration among farmers in various districts was determined to increase the production of beef cattle and to promote beef cattle farming career to create sustainable income for farmers.

Therefore, researchers aimed to introduce the technology transfer of beef cattle raising to farmers who were members of each group of beef cattle farmers in order to increase in production through the intensive farming practice in Pua district, Nan province. The research also aimed to develop a system to increase the quality of beef production regarding its quantify and quality for farmers in the future.

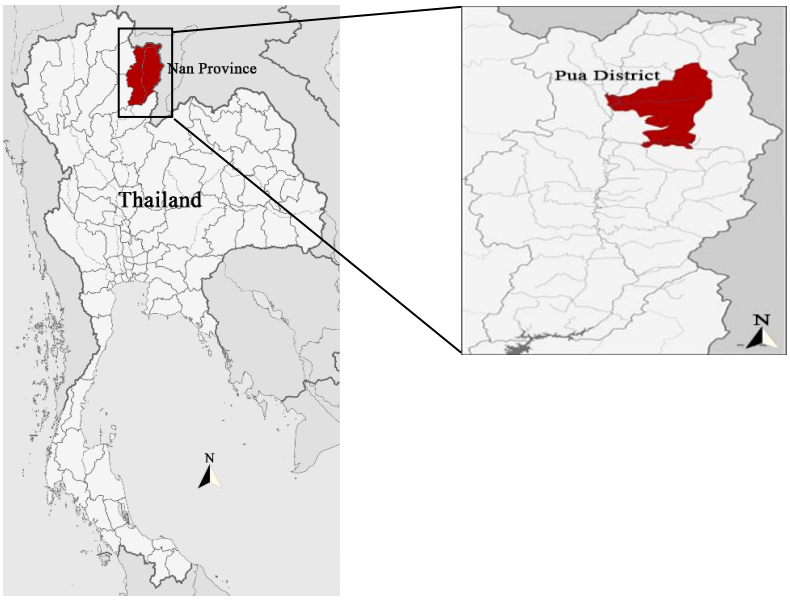

Figure 1. Map showing the study locations in Pua District, Nan Province, Thailand

Materials and methods

Study area and sample size

The participants in this study were 45 farmers, members of the beef cattle raising group; in Pua district, Nan province. The sample group included the president and representatives of each group's committees and farmers who are members of each group and interested to participate in the activity. Data were collected from February 2017 to August 2018. The participatory Action Research (PAR) method was used as the main method for this research. Various actions were carried out to create knowledge and skills essential for beef cattle farming in accordance with the intensive farming practice. Actions included a survey of the area, in-depth interviews with group president and group committee with the total number of 5 people, interviewed protocol for the group of beef cattle farmers consists of 45 members, organized a focus group discussion with 8 representatives of each group, conducted of a training workshop on technology transfer to members of the group, and a survey collected from the training workshop. The study used the technology transfer process to adjust with System Approach adapted from O'Brien James (1990) as shown in Figure 2.

System Approach	General Problem-solving	Tools
1. Understanding the issues or Need Assessment	1. Problem Identification 2. Data collection is used to explain problems and acquired opportunities.	1. Observation 2. In-depth interview with the committee and the president of each group. 3. Interview form given to the farmers.
2. Alternative Development	3. Identify approaches to the solutions 4. Evaluated the different alternatives 5. Indicating the best solution	4. Focus Group Discussion with the representative from each group.
3. Problem-solving operations	6. Implementing the selected procedures 7. Assessing the achievement of alternative activities.	5. Workshop 6. Evaluation form for training Workshop.

Figure 2. Technology transfer process adjustment in accordance with the System approach

Data analysis

Data were analyzed into types. Firstly, data were used descriptive statistics to explain the data characteristics and statistical values such as frequency, percentage, mean, maximum, minimum, and standard deviation. These statistical values were explained some essential information and the conditions of beef cattle raising of farmers who were members of beef cattle farming groups in Pua district, Nan province. The analysis also explained the results of the knowledge assessment before and after the training workshop of participants attended the training. Secondly, data were also analyzed through content analysis. Information was observed and surveyed to explain the process of technology transfer of beef cattle for the increasing of production through intensive farming. Data were analyzed from the in-depth interviews, focus group discussions, and organizing workshops.

Results

The research finding was transferred the technology of beef cattle raising productivity improvement based on the intensive farming practice by operating the technology transfer process in adjustment with the system approach. It was also involved in the process of understanding the issues or need assessment. The result from the step of the alternative development and problem-solving operations were shown as follows:-

The process of understanding the issue or need assessment

Problems identification

The observation across the area with the in-depth interview with president of each group and the committees, found that the majority of the farmers continuously to encounter with the problems about raising beef cattle which included three important issues:- issue 1 was the majority of the farmers considered small scale farmers which raised approximately 10 beef cattle or 87.23 percent. Additionally, 23.40 percent of the farmers grazed the beef cattle on their pastures/fields or in public areas and drove them back to cattle shed in the evening. Issue 2 was an approximately 80.85 percent, the majority, of farmers prepared forage plots for rearing their beef cattle, however; the feed was insufficient to provide them annually. Therefore, they prefer to use agriculture residues that exists in the community such as rice straw, corn dust, and corn husk for animals as a substitution, especially during the dry season. The expressed farmers' majority issue was inaccessibility to the market of forage seeds and crops as well as limitations on the areas to plant forage crops. Importantly, most farmers lacked knowledge concerning the management of forage crops and adding nutritional value to agricultural residues appropriately. Issue 3 was some farmers neglected the importance of vaccination especially for foot and mouth diseases and hemorrhagic septicemia. Farm livestock needed to be vaccinated their animal annually. However; it was impossible to transfer livestock to sell outside of the area without holding an issued license. Therefore, the price was often pressed by the merchants in the area.

Issues and opportunities

The 45 people were interviewed members of beef cattle farming group including the president and the committee. The finding concluded that the majority of the farmers were male, with an average age of 53.74 acquired only primary education and their major occupation was a farmer. Famers earned an average of 21,936.84 baht from raising beef cattle. However, the average debt they owed from beef cattle investment was 190,931.03 baht. Mostly, the budget was come from their private saving and the Bank of Agriculture and Agricultural Cooperatives. The reason was that most of the farmers with an average percentage of 63.83 percent had not contacted and communicated with the staff members promoting beef cattle raising. Regarding the condition of beef cattle farming, this study also found that farmers had 3.80 years of average experience in raising beef cattle. They had on average 7.47 percent of beef cattle in an average area of 2.76 acres and 65.96 percent of farmers targeted to raise beef cattle in order to sell their calves. Thus, farmers prefered to raise 74.47 percent of crossbred cattle and 46.81 percent of native species. Family labor was used to raise beef cattle with an average of 1.91 laborers. Nevertheless, most farmers

raised their beef cattle by allowing the cattle to stand in the cattle shed or kept them in it and fed them with grass or condensed feed. In contrast, some farmers was naturally raised their beef cattle by grazing on their pastures/fields or in the public areas. However, 70.21 percent of the farmers did not recorded their beef cattle, and 91.49 percent had no prior knowledge in beef cattle farming with the intensive farming practices.

The approach of trading in beef cattle found that 91.49 percent of farmers sold beef cattle as single price, and mainly sold to the dealer who constantly come to purchase beef cattle in the village. The study indicated that few factors had affected the decision of farmers in selling beef cattle, especially the need of money for their family and to avoid pandemic when the purchasing price of beef cattle increased.

Alternative Development

Identifying approaches were evaluated different alternatives and to indicate the best solution. The researcher organized the focus group discussion with the representative of the members of the farmers to inform the results of the study in beef cattle raising, created the opportunity to identify approaches to the solutions, evaluated difference alternative, and indicated the best solution (Figure 3).The finding was determined that farmers requested to have technology transfer of beef cattle to increase production which established on the intensive farming practice. They requested both workshop and training for the whole day. The activity was held in May, and only time the majority of farmers had available time before rice cultivation.

Technology transfer found that the majority of farmers had a lack of knowledge in raising beef cattle based on intensive farming practice. Thus, the information was shared into 3 aspects:- raising beef cattle based on intensive farming approach to increase production, planting and managing the forage that was suitable for the area and technique of beef cattle raising for farmers, and the usage of agriculture residues existed in the community as a coarse feed for fostering beef cattle reduced the investment of the production as demonstration and practices to the farmers.

Figure 3. In-depth interviews with the leaders of the group, collecting data form farmers through the interview protocol, and having focus group discussions with the representatives of the farmers

Problem solving operation

Implementing the selected procedures: the true demand of farmers in the area and the importance of the appropriateness and consistency of the project objective were considered. Immediately, they determined to have workshop and training on May 30th,2017, with the project title of "Technology Transfer of Beef Cattle Raising for Productivity Improvement based on Intensive Farming of Beef Cattle Raising Group in Pua District, Nan Province.". The meeting was held at Ban Don Chai meeting room, Silapetch sub-district, Pua district, Nan province. The training workshop received collaboration from related departments including Pua district Livestock Office, president of Beef Cattle Raising Group in Na Noi district, Nan Province, staffs of Phrae Animal Research and Development Centre, lecturers from Faculty of Agriculture and Natural Resources, Phayao University.

These departments facilitated the speakers to transfer knowledge related to supplementary for forage as materials and equipments which needed to make quality coarse feed for beef cattle raising for the farmers participating in this workshop (Figure 4).

Figure 4. Organized training workshop for beef cattle farmers

Assessing the achievement of alternative activities

The knowledge evaluation form to test the knowledge of farmers before and after the training workshop to transfer beef cattle farming technology for productivity improvements based on intensive farming practice with farmers who participated in this workshop was resulted. The result was explained in below paragraphs.

Knowledge level before and after the training:-the development of beef cattle farming associated with the practice of intensive farming found that the knowledge of farmers before the training was at the moderate level or average mean of $\overline{X}$ =2.36 and after completing the training, it was found that farmers acquired more knowledge with a very high level with the mean of $\overline{X}$ =4.65. The development of planting and managing forage were suitable for the area and beef cattle raising found that farmers had averaged knowledge with the mean of $\overline{X}$ =2.84 before joining the training and after completing the training, it was found that farmers acquired more knowledge

at the very high level with the mean of $\overline{X}$ = 4.53. The development of the usage of agriculture residues existed in the community as a coarse feed for fostering beef cattle in reducing the product investment discovered that before participated in the training, farmers' knowledge was at the moderate level of mean $\overline{X}$ =2.98, and after the training, their knowledge improved at the very high level with the mean of $\overline{X}$ =4.67. In addition to the findings, the survey regarding knowledge developed from the transfer of technology which was adapted by the farmers in raising beef cattle (Table 1).

The knowledge gained from the transfer of technology after farmers complied with the knowledge for raising beef cattle and the study found that the 62.8 percent of farmers who participated in the training workshop had applied the knowledge they received and adapted to their beef cattle farming at the very high level (Table 1).

Table 1. The comparison of knowledge before and after the transference of technology to increase the productivity of beef cattle farming associated with the intensive farming practice (N = 43[2/])

Survey Items	knowledge before participated in the training workshop						$\overline{X}$	Interpretation[1/]
	Very high	High	Moderate	Low	Very low	No knowledge		
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)		
1) The development of beef cattle farming associated with the practice of intensive farming								
Knowledge before training	3 (7.0)	11 (25.6)	10 (23.3)	15 (34.9)	4 (9.3)	0 (0.0)	2.86	**Moderate**
Knowledge after training	28 (65.1)	15 (34.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4.65	**Very high**
2) The development of planting and managing forage that is suitable for the area and beef cattle raising								
Knowledge before training	1 (2.3)	10 (23.3)	16 (37.2)	13 (30.2)	3 (7.0)	0 (0.0)	2.84	**Moderate**
Knowledge after training	24 (55.8)	18 (41.9)	1 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	4.53	**Very high**
3) The development of the usage of agricultural residues exists in the community as a coarse feed for raising-beef cattle in reducing the product investment								
Knowledge before training	0 (0.0)	17 (39.5)	13 (30.2)	9 (20.9)	3 (7.0)	1 (2.3)	2.98	**Moderate**
Knowledge after training	32 (74.4)	9 (20.9)	1 (2.3)	1 (2.3)	0 (0.0)	0 (0.0)	4.67	**Very high**
4) Applying knowledge from training and adapted in their own way								
Adapt the knowledge from training and apply on farm	27 (62.8)	14 (32.6)	2 (4.7)	0 (0.0)	0 (0.0)	0 (0.0)	4.58	**Very high**

[1/]Interpretation by the average score of the workshop are ranked as follow: 0.00-0.83 = no knowledge, 0.84-1.67 = very low level of knowledge, 1.68 - 2.51 = low level of knowledge, 2.52- 3.35 = moderate level of knowledge, 3.36-4.19 = high level of knowledge and 4.20 - 5.00 = very high level of knowledge

[2/]45 farmers participated in the training, however; only 43 participants submitted the evaluation forms with the average percentage of 95.56 percent.

Discussion

Technology Transfer of beef cattle raising for productivity improvement based on intensive farming of beef cattle raising was studied. It concluded that knowledge of farmers participated in the training workshop of technology transfer of beef cattle raising, improved after they received the information relevant to their needs and concern in raising beef cattle. They could apply the knowledge which acquired to the real beef cattle farming. Therefore, the demand of need assessment in training was important at the primary stage in training. It is consistent with Sullivan *et al.* (1990) that people motivated to learn when they desired to know about something. Moreover, the farmers were allowed with the opportunity to participate in various training and activities incorporated with the need assessment, alternative development and the action taken by the participant in problem-solving. Hence, it resulted to stimulate the desire of farmers to learn and contribute a better collaboration which it is consistent with Knowles (1978). He explained that learner's experience is considered as a valuable learning resource, active participation from learner's experience should be equipped to manage the methodology used in training and, importantly, the majority of them would be aware of the problems related to their real life. Therefore, the information used in the training workshop should relate to the actual situation participants encountered as a guideline for better understanding.

In addition, the results also revealed that the adjustment of shifting beef cattle raising from extensive system to intensive system or commercial livestock rearing should start from changing the fundamental perspective of farmers as the primary stage. It may begin to provide information and knowledge while developing the correct technique of beef cattle farming according to the principle of agriculture that consistent with Wetchakama *et al.* (2017) that the related government departments should inform the information in promoting the productivity and beef cattle market for farmers through training and enable farmers to learn and exchange knowledge among farmers. Furthermore, promoting a model of a successful beef cattle farmer in the area was an alternative way to show other farmers. A concrete model would increase the incentive and the willingness to attempt and is applied by the farmers. In the meantime, the associated departments must provide assistance to support in various fields continuously. In order to promote the intensive beef cattle farming in the area, assessing farmer readiness is measured in three areas in the following. 1) Readiness of the farmers who should concern the academic readiness, skills, owner's capital and investment, and a great fondness for beef cattle farming. They are considered as an innovator and early adopter which consistent with Sompong (2000) who stated the majority of farmers in these two groups had relatively good economic status, well educated, progressive thinking and

expert in businesses. They had the willingness to accept, follow and cooperate with the staff and ability to develop as a model farmer. Importantly, the related government department must continuously support the transfer of knowledge and skills in intensive beef cattle farming as continuously supporting factors of farmers' basic production. 2)Raising intensive beef cattle farming was important to access the physical and biological readiness in the certain area which considered as a factor supporting the achievement of intensive beef cattle farming. For instance, the numbers of beef cattle should be equivalent with the numbers of the family laborers, range of the area, owner's capital, and sources of water. Significantly, it is important to consider the relationship of the quantity of natural resources animal fed on with the natural resources that exist or flourish in the area of the farmers, or with the agricultural residues that used as good coarse feed for beef cattle in the area. 3) Readiness of market receiving products was shown the major factor to determine the procedures to promote the intensive beef farming for farmers in the area which in consistent with Opatpatanakit and Sethakul (2005) that market is an important factor to define the system of beef cattle farming. Therefore, the support of intensive farming to farmers should focus on the productivity that would be sold only into two types of market as premium market which focuses on the production of beef with marbling fats to compare the quality with international markets with the lower price. However, Angkuraseranee *et al.* (2019) stated that farmers preferred to raise crossbred beef cattle such as Angus, Charolaise, and Wagyu with high blood level and used intensive system. However, farmers should create the plan for the production with the private company that purchases the product. Middle market focuses on the quality of beef products such as Crossbreeds Brahman, Angus, and Charolaise that sold in to fresh-meat markets and restaurants. In this way, farmers will use a shorter fattening period than beef cattle raising that was sold in the upper market (premium market). However, the purchase price is determined by the need of the consumers and beef quality. Currently, the study found that beef cattle farmers in the forms of cooperative group and private companies are increasingly interested in this market.

Although, the intensive farming would advantages over extensive farming, and requires a period of time to transform the pattern of beef cattle raising for farmers in the certain area. The majority of the farmers are still adhering to their belief and method of raising beef cattle that have accumulated from their ancestors. Consequently, encouraging beef cattle raising based on intensive farming is gradually developed to occur among groups of farmers associated with the Learning Network and Business Network. Therefore, government departments, private sector, and local people to persistently collaboration.

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