CHAPTER 4

RESULTS AND DISSCUSSION

The main objective of this research in Mae Jam District, Chiang Mai Province, was to developa model of agricultural extension to reduce corn biomass burning. This research was conducted by using mixed methods consisting of quantitative research, qualitative research, and participatory action research. Data was collected from farmers who grew corn in three sub-districts in Mae Chaem District, ChiangMai Province including Mae Na Jorn Sub-District, Ta Pha Sub-District, and Chang Kerng Sub-District. The obtained data was analyzed quantitatively and qualitatively and the content analysis was divided by the researcher into three stages as follows:

4.1 Stage1: Development of the Model of Agricultural Extension to Reduce Biomass Burning Consisting of Two Sub-Stages:

4.1.1 Community stages were set for discovering the causes of biomass burning and guidelines for reducing burning, presenting the model, mutually discovering the model of agricultural extension to reduce biomass burning as well as recruiting some volunteers to participate in this research to test the model of agricultural extension to reduce biomass burning.

4.1.2 Focus groups were set up to study the possibility and readiness of utilizing the model of agicultural extension to reduce biomass burning as well as to discover the guidelines for conducting the research project to test the appropriateness of the model.

4.2 Stage2: Testing the Appropriateness of the Model of Agricultural Extension to Reduce Biomass Burning Consisting of Two Sub-Stages:

4.2.1 The results of quantitative research were obtained from testing the utilization of the model of agricultural extension to reduce cornbiomass burning.

4.2.2 The results of the test on the appropriateness of the model of agricultural extension to reduce corn biomass burning were obtained from anylzing differences based on the Paired T-Test and path-analysis.

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4.3 Stage3: Lessons Learned Visualizing the Participation in the Experiment of the Model of Agricultural Extension to Reduce Corn BiomassBurning

4.1 Stage 1: Development of the Model of Agricultural Extension to Reduce Biomass Burning

The researcher invented a standard model of agricultural extension to reduce corn biomass burning by using the model development method of Kendal and Kendal (1988), The analyzing of the corn growing system of the farmers in the area of Mae Chaem District started from understanding their method of the preparing the area, growing and harvesting, and methods of biomass elimination. Suggestions for guidelines on utilizing biomass without burning were taken. In addition, the researcher studied the processing methods of biomass for producing other products which offered additional income to farmers. Subsequently, the researcher designed the system of the model after considering its inputs such as labor, biomass materials, biomass processing, and obtained products for further utilization. The researcher also sought out appropriate channels for utilizing or distributing the processed biomass by considering the ease of management of the system for farmers growing corn as well as the benefits or impacts on the environment and sustainability based on self-reliant management for farmers growing the corn.

To invent the standard model, the researcher studied some related theories, principles, and research, for example, the Appropriate Technology Theory of Roger and Shoemaker (1983), the Technology Acceptance Theory of Roger and Shoemaker (1978,p.76), the Pricing Theory ofThomas. A. Weber, Work Simply Principles, and Basic Biomass Processing or Milling, in order to find the important factors that would be the main elements of the structure of the model as well as to understand the logic leading to the determination of the relationship of the factors or variables and the direction of the relationship of variables in the model. From such study, the researcher was able to present the standard model as follows:

Figure 4.1 The Model of Agricultural Extension to Reduce Corn Biomass Burning in Mae Chaem District, Chiang Mai Province

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4.1.1 Setting the community stages

The researcher set up community stages to present the model in three locations including Mae Na Jorn Sub-District, Ta Pha Sub-District, and Chang Kerng Sub-District. The format of activities used in each location of community stages was the same and the researcher invited some farmers with experience in growing corn to discuss their opinions, and suggestions. Moreover, the researcher also invited some relative people (e.g., committees of subdistrict administrative organizations, village leaders, village chiefs, and community leaders) to participate in such discussions. The time and date of each community stage and the number of participants were as follows:

1st Community Stage: It was set in Mae Na Jorn Sub-District on Friday 3rd October 2014 and consisted of nineteen villages. The researcher invited three farmers from each village and as a result the total amount of participating farmers was fifty-sevenplus five relative people. The total number of participants was sixty-two.

2nd Community Stage: It was set in Ta Phaq Sub-District on Monday 6th October 2014 consisted of ten villages. The researcher invited four farmers from each village therefore the total amount of participating farmers was forty plus withfour relative people. As a result, the total number ofparticipants was forty-four.

3rd Community Stage: It was set in Chang Kerng Sub-District on Thursday 9th October 2014 consisted of nineteen villages. The researcher invited three farmers from each village and as a result the amount of participating farmers was fifty-seven plus with five relative people. The total number of participants was sixty-two.

The activities of the communication stage started by raising the issue of corn biomass burning in Mae Chaem District,Chiang Mai Province, as well as the health, economic, and social impacts of the smoke occurring in the dry season affecting people living in Mae Chaem District and nearby provinces. Subsequently, the participants were asked questions as follows:

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Question 1: They were asked to express their opinion toward such problems. From the opinions of farmers participating in the community stage, it could be concluded that they realized that corn biomass burning was the cause of such problems.

Question 2: They were asked why they had to burn thebiomass caused by corn growing. Many participating farmers responded that it was convenient and economical as well as easyto eliminat**e**. In addition, they also added that there was no other way that was as convenient and economical. Some farmers replied that biomass burning was the method thathas been taught from previous generations and they belived that even if theyrefused to burn biomass, other farmers would burn it anyway. Moreover**,** some farmers belived that burning was the way of eleminating some vector borne diseases that could affect the new season's crop as well as simultaneously eliminating some pests. Moreover, burnt biomass became the charcoal or ash helping to improve the soil's minerals. Some farmers answered that they had no knowledge of other methods of eliminating large amounts of biomass besides burning.

The researcher presented the methods of utilizing cornbiomass to replace burning by explaining methods for each format of utilization. The methods of utilization were derived from the previously known knowledge that had been developed and was improved upon for practical utilization.For example,making fermented fertilizer, making cow feed, makingwood pallets, making charcoal briquettes, flooring stalls, or making material for growing mushrooms by replacing the saw dust from rubber trees. Farmers expressed their interest in making corn biomass the material for growing mushrooms and making fermented fertilizer based on the new method as explained by the researcher. They were especially keen on the idea of primary milling before fermenting because it could reduce the duration of fermentation by 30%.The duration of fermentation would not be more than 30 days. Making cowfeed was of interestby some farmers because they

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thought that this would help to reduce the problem of the lack of cow feed in dry season. As for the other methods, (e.g., making wood pallets, making charcoal briquettes, flooring stalls), there were no farmers interested. As a result, it was concluded that the researcher would use three guidelines for promoting biomass utilization: utilizing biomass for making fermented fertilizer, material for growing mushrooms, and using it as cow feed. These would be the methods used as the tools for motivating farmers to reduce corn biomass burning.

The researcher raised some issues and gave the farmers the opportunity to express their opinions toward what the method of biomass processing should be if cornbiomass was processed for economic benefit in lieu of burning. The farmers were motivated to express their opinions and analyze the weaknesses and strengths, opportunities and threats of such activities of operation. The farmers were interested in these activities and mutually brainstormed based on the method of building a mind map. The obtained answers showed that the strength was that if farmers knew how to mill corn biomass for economic utilization, they would be glad to follow and discontinue the biomass burning. The weakness was that farmers had no funds to purchase the biomass chipper for such operation and they were not confident about controlling and operating such a chipper efficiently. Farmers had no idea how much they would have to pay for this operation or whether distributing or utilizing the obtained products would be worthwhile because it was still a new method that they had never seen explicitly done before. The threats of this operation were the expense of providing the equipment and tools, as well as learning how to operate, maintain, and transport those tools for using at the production site.

The researcher presented the model of agricultural extension to reduce cornbiomass burning and explained to all the farmers and relative people at the communication stage how this operation should be done if there were the equipment, tools, and labor cost for transportation. The farmers were

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asked for their cooperation in bringing their corn biomass,that they left after harvesting and its cobs, to the location of the corn husker where the researcher set up the biomass chipper. After completing husking the corn, the corncobs and their shells obtained along with the biomass materials brought in from the farms were milled into the biomass powder. Subsequently, the corn dust material was contained in 25 kilogram bags and transported for utilizing or distributing to consumers.

Direct utilization of powdered corn biomass,for example, using it as the material for growing mushrooms in lieu of saw dust of Para rubber trees or using it as fermented fertilizer to replace chemical fertilizers, helped to reduce high production costs. All organizations of agricultural extension were responsible for providing training and knowledge on processing the corn dust material to become a product with economic value as well as help reinforce the market to sell and purchase it. This method had the ability to support this cycle and was practical and became a source of income for the farmers. Consequently, the mechanism of collecting biomass for utilization instead of burning it solved the problem of smoke and pollution caused from burning the agricultural waste. (as shown in Figure 1).

Farmers mutually discussed the appropriateness and possibility of utilization of the model by considering 4M Management, (Man, Money, Material, and Management). From the results of discussion, it was found that it would not be difficult to take actionwhen considering workforce, because farmers were be able to carry the biomass materials from their farms to the location of the husker themselves. Since farmers had to carry the cornfrom their farms to be husked, carrying the biomass from the farms to be utilized would depend on the worthiness of the expense, for example, labor costs, cost of the truck for transportation, milling costs, packaging costs, and costs of maintenance. If those expenses were worthwhile, this process could be performed.

The farmers' perception on the supply was obtained from this community stage, the researcher determined the value of corn dust through pricing the

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minimum price of corn dust obtained from milling at the location of the husker at 1.00 baht per kilogram. The reason for such pricing was due to the burden of the cost and expenses of corn dust production. The researcher continued to develop the chipper until obtaining the efficient chipper for milling corn biomass. In addition, the researcher also found that the cost was less than 0.50 baht per kilogram. If the cost of machine was set at 0.20 baht per kilogram, the margin earned by the farmers after deducting expenses would be 0.30 baht per kilogram or a profit of 300 baht per ton. As a result, if farmers were able to mill corn dust in the quantity of 10 tons per day, they would gain profit of 3,000 baht per set of chippers. Since the cost of chipper was 300,000 baht and the depreciation was 200 baht per ton, the biomass must be milled by the chipper in the quantity of 1,500 tons. Consequently, the payback period of such machine was 1,500 hours. If the duration of the operation of such chipper was divided into two periods, i.e., 750 hours per productive season or the duration of such milling of two and a half months per year, the payback period would be two years. Based on business principles, any business with only two years of a payback period would be considered as a good investment. Since the payback period was short, the opportunity for investment was high while the business risk was lowered.

When considering the demand for corn dust, it could be utilized in various ways.For example, using it as the material to replace the saw dust of Para rubber trees because Para rubber tree dust was ordered by people in the northern part of Thailand from the sourthern part of Thailand for growing mushroomsat a minimum price of 2.00 baht per kilogram. An experiment conducted at Chong Charoen Farm located in Mae Wang District, Chiang Mai Province that used corn dust for growing oyster mushrooms, phoenix oyster mushrooms, white mushrooms, and Lom Pa mushrooms found that it resulted in as good a product as the Para rubber dust. This proves there is a market for corn biomass dust. As a result, it could be seen that there was

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the gap between the production cost and the cost of utilization in the amount of 1.00 baht per kilogram. With the price gap of 1.00 baht, the marketing cycle of products could be generated more easily.

It also could be used for animal feed. TMR (total mix ration) or total mixed food was used for feeding cows in dry season when there was a lack of grass for feeding animals. Corn dust could be mixed with minerals or some nutrients according to a defined formula. According to the principles of animal feeding, the duration of anaerobic fermentation was approximately 21 days yielding silage that was the feed for ruminants with the cost of production per kilogram of no more than 8.00 baht. When comparing that to the instant feed, the normal price of instant feed was up to12.00 baht per kilogram. This price gap was an opportunity for using corn dust for feeding cows in dry season.

For making fermented fertilizer, the corn dust would also be able to be mixed with 25-30% of animal droppings, microbes from the Land Development Department and 10 kilograms of molasses per 100 liters of water. Subsequently, this fermented water would be mixed with corn dust and animal droppings until the moisture level of this mixed biomass was approximately 40-50 %. During fermentation, the mixture must be piled up under the shade with good ventilation and the moisture level must be monitored and not be lower than 40% to gain efficient fermentation. The duration of the fementation process using corn dust would be less than normal materials by 30%. Consequently, although fermentation with corn dust may have a higher amount of milling

costs, it helped to save time and improve efficiency of fermentation. With this method, the efficient fermented fertilizer could be obtained within approximately 30 days.

From the data on processing with the chipper, it was found that the occurred cost and rewards were in accordance with those explained and answered by

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the researcher. Consequently, farmers were able to understand the cycle of utilization and gave their opinions that such a method would be appropriate and possible to be used as the tool for managing biomass.

When considering management, the first issue was chipper management, i.e., there must be someone controlling the chipper.That may be any person in the community as the process of chipper controlling would not difficult or complicated. The following issue would be processing corn dust materials into various types of products, for example, making material for growing mushrooms, making fermented fertilizer or fermented feed. Farmers had the opinion that if the organizations on agricultural extension provided training and knowledge on biomass processing, they were ready to participate in such training because they thought that the information they obtained from this seminar would provide them with the perception that such principles would be highly possible and practical. If they had an opportunity to participate in any training related to this area, they may earn more income and new occupations from biomass processing.

When considering the machines used in milling biomass or the chipper, the researcer tested the machine developed from those available in general markets and studied occurring problems before solving these problems until the chipper was able to mill corn biomass efficiently under the cost of fuel per produced biomass at 0.50 baht per kilogram. To mill biomass by using the developed chipper, the cost of production was approximately 300,000 baht. In the event that the related organizations (e.g., agricultural organizations, local administrative organizations, organizatinos on natural resources and environmental or other related organizations) supported the funding for the cost of the chipper, the project could be established sooner and the number of participating farmers could be increased, too. When farmers would earn income from selling the biomass

material obtained from this project, they had to reserve 20-30% of that income for an additional fund for future maintenance and procurement of of

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the chipper. As a result, such cycle would be able to be driven continuously by the mechanism of income earned from distributing the product made of corn dust in every season of corn production.

The discussion continued by mutually considering money or the cost of such a process and the farmers also discussed marketing and purchasing price.The researcher had already instituted some marketing channels. From the start of the cycle of biomass utilization, there were some questions on the expense of transportation, processing, and procedures of utilization for earning a worthwhile income and rewards for the business operation. If those questions could be answered reasonably, the model of this research would be able to be used in agricultural extension practically and applied with other areas with corn plantation.

The researcher illustrated the cycle of utilization of corn biomass for making material for growing mushrooms through the obtained data from this study. One cycle of mushroom growing would take approximately 6 months and one mushroom consumed around 0.80 kilogram of corn dust. If biomass was promoted to be produced for 3,000 units per household every month, the biomass that would be utilized would be approximately 24,000 kilograms per household. If farmers of each sub-district growing corn were promoted to produce mushrooms from cornbiomass, 240,000 kilograms of biomass would be utilized per month yielding 48,000 kilograms of mushrooms per monthapproximately. This quantity of mushrooms was be able to divided into two parts, for consumption and distribution, i.e., the obtained quantity of mushrooms at 1,600 kilograms per day and 1,000 kilograms per day may be exported to other areas and 500 kilograms consumed in the local area.

If the fresh mushrooms were priced at 50 baht per kilogram, the additional value of mushroom production would be 2,400,000 baht. As a result, it meant that farmers would earn m 24,000 baht additional income per month

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per household and 2,680,000 kilograms per year of the cornbiomass would be utilized. If there were a bigger market for supporting this product, farmers would be promoted to increase their biomass products. Consequently, the cycle of utilization of biomass to produce the material for growing mushrooms would consume more biomass. For making fermented fertilizer, the total cost of milling would be only 1.00 baht per kilogram . Other ingredients included 300 kilograms of manure (with the price of 5.00 baht per kilogram calculated to be 1500 baht), 50 kilograms of molasses (with the price of 12.00 baht per kilogram calculated to be 600 baht), 2 packs of micro-organisms (PorDor 1)dissolved with 400 liters of water and such molasses. Subsequently, all ingredients would be fermented for 10 days until some scum or microbial fiberswere visible and floating on the water. Afterwards, 1,000 kilograms of corn dust would be mixed with 400 liters of the prepared fermented water. All ingredients would be blended well and piled up under the shade with good air ventilation for25 days. Finally, good fermented fertilizer would yield with the primary production cost of 1000+1,500+600 = 3,100 baht per ton. As a result, farmers would obtain fermented fertilizer at the approximate cost of 3.10 baht per kilogram. If the labor cost was increased to 1.00 baht per kilogram, the cost of this fermented fertilizer would be only 4.10 baht per kilogram that could be utilized with 4-5 rai of plantation area.

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As a result, each farmer's household would be able to use approximately 10 tons of corn dust to produce fermented fertilizer for improving the nutrients of plants for plantation covering 40-50 rai of plantation area. Consequently, this cycle would be able to utilize biomass in the large quantitices. If 10 tons of biomass were utilized for making fermented fertilizer, 1,000 tons of biomass would be utilized in making fermented fertilizer for 50,000 rai of plantation area.

For making fermented cow feed, the business reward was big but there were some weaknesses, i.e., there was a large amount of cows needed to eat such

feed and the life cycle of the cow needed to be over three years to earn any income from selling such a cow. Another important limitation was that there needed to be a long period to expand the quantity of cows to eat such fermented feed. As a result, the cycle using cows for
eliminating corn biomass may be the third alternative after making biomass as material for growing mushrooms and fermented fertilizer. Making biomass as material for growing mushrooms and fermented fertilizer were more suitable for eliminating biomass in the first period while making biomass as cow feed should be performed together because it was necessary to spare some time for generating sufficient cows that would subsequently eat fermented food and would become the source of additional value of corn biomass in long-term.

From lectures on the guidelines of biomass processing and marketing utilization, the farmers saw the possibility obtained from participating in this project. The researcher asked some questions of the participants regarding their opinions toward the model of agricultural extension for utilizing biomass in lieu of burning.
Most participants, or 70% of participants, agreed that this model would help to reduce biomass burning and there was such a high possibility that this model would be practical because it was not complicated,had a low cost and explicit reward as proposed by the researcher. As a result, it was believed that this model would be able to solve the problem of air pollution caused by corn biomass. This was considered as cooperation in taking responsibility for health problems of the public affected by the pollution and smoke caused by corn biomass.

The last question asked by the researcher to the participants was whether they would be interested in participating in the research project to test the appropriateness of the model of agricultural extension to reduce cornbiomass burning. It appeared that farmers of each community stage showed their interest to participate in the project as follows:

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a) Forty-five farmers from the community stage set at Mae Na Jorn Sub-District

b) Thirty-five farmers from the community stage set at Ta Pha Sub-District

c) Forty farmers from the community stage set at Chang Kerng Sub-District

d) Subsequently, the researcher asked the participants of each community stage to pass on this knowledge to other farmers in their communities and thanked all participants.

4.1.2 For focus group setting

the researcher held the focus groups with theparticipation of some farmers growing corn to discuss and study the possibility and readiness of utilizing the model of agricultural extension to reduce biomass burning. To operate the focus groups, the researcher selected one representative per village of farmers growing corn based on purposive sampling. Farmers with experience in growing corn no less than five years and living in Mae Na Jorn Sub-District, Ta Pha Sub-District, and Chang Kerng Sub-District, were selected to participate in these focus groups. The sample size consisted of seven farmers from Mae Na Jorn Sub-District, six farmers from Ta Pha Sub-District, and six farmers from Chang Kerng Sub-District**.** The researcher held three focus groups as follows:

a) 1st focus group held at Mae Na Jorn Sub-District on Saturday 8th November 2014 with seven participants

b) 2nd focus group held at Ta Pha Sub-District on Tuesday 11th November 2014 with six participants

c) 3rd focus group held at Chang Kerng Sub-District on Friday 14th November 2014 with six participants.

From those three focus groups, the issues could be concluded as follows:

a) Management of corn biomass of farmers in Mae Na Jorn Sub-District,from in-depth interviews and focus groups found that, farmers often harvested their corn using family labor. Farmers harvested their corn by breaking its cob and kept it in the sack before loading it on the truck for

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transporting to the nearest husker that is often located within 15 kilometers of their farms. At the location of the husker, there would be the corn biomass, i.e., corn husks and corncobs obtained from huskingincreasingly piling up. During the harvesting time, the researcher asked the farmers whether they utilized any biomass located at the husker area. Most farmers replied that such biomass was not utilized and most of them leave such biomass at the location of husker. Subsequently, the husker controller would burn such biomass gradually.

b) Mr. Kam (pseudonym, farmer from Group 1) said," I had no idea what I should do with such biomass. After husking, I earned from the corn seed then I went home." Mr. Kong Kum (pseudonym, farmer from Group 1) said, "If we knew that biomass could be sold or milled for other benefits, we would do." Mr. Dee (pseudonym, farmer from Group 1) added, "If there were some chippers for bringing home or any available chipper with small charge, I would bring biomass to be milled with such chipper for making fermented fertilizer or animal feed." These opinions showed that farmers lacked knowledge on utilization of husked corn. When the researcher asked how farmers manage the remainings of corn leaves and stems, most farmers replied that they left those leaves and stems to dry before burning due to such large amounts. However, there were a few of them who ploughed those leaves and stems in their areas. Mr. Ngern (pseudonym, farmer from Group 3) said,"Some farmers with money or a pushcart would plough those leaves and stems to make fermented fertilizer." Mr. Nueng (pseudonym, farmer from Group 2) added to" Those leaves and stems were ploughed or left on the farm as the feed for termites." For this issue, Mr. Saman (pseudonym, farmer from Group 2) said, "Some farmers piled up those leaves and stems on the ground without knowing what to do with them. Actually, they don't want to burn those leaves and stems but they may be burned naturally so those farmers choose to burn those leaves and stems by themselves."

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The researcher asked whether they would perform this model if they knew that biomass was able to be utilized for gaining more income. Mr. Ai (pseudonym, farmer from Group 1) replied,"If there was any officer providing knowledge or training on how to utilize such biomass, they would do that because they could earn money from such a process." Mr Nor (pseudonym, farmer from Group 3) asked the researcher, "Where is the place to sell such biomass?" The researcher explained to such farmer the ideas for places for selling such biomass and told them that they were able to keep such biomass in their farms as well, therefore they could reduce the expense of fertilizer they used to buy from others. Mr. Singha (pseudonym, farmer from Group 1) said,"I used to see some farmers utilize such biomass for making feed. Some of them also utilized such biomass forgrowing mushrooms and making fertilizer". The researcher asked again whether farmers would process biomass if they knew that it could be processed as a product with economic benefits. Mr. Ngern (pseudonym, farmer from Group 3), Mr. Kam (pseudonym, farmer from Group 1), and Mr. Saman (pseudonym, farmer from Group 2) mutually replied in the same way that "If we first know it can be sold or utilized for making fertilizer or growing mushrooms, we won't burn such biomass. We would like to ask some officers to provide us training, knowledge, and suport on a chipper and the market."

The researcher explained to those three groups again on the model of agricultural extension to reduce biomass burning and asked them whether they thought that they could perform this process if they had to adopt this model and what their opinions toward such a model were. The farmers gave their opinions that such a model had the possibility of practical usage if they earned support or knowledge, training and practice on the machine or chipper, as well as support for transportation and a market for selling such biomass products. For labor management used in transporting corn biomass to the location of husker, it could be performed by the farmers. For the

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chipper, there should be a controller provided at the location of the husker. If there was no controller available, some farmers who were trained to control the chipper may be employed daily to perform such a duty. Most farmers had the opinion that the technology of processing biomass material for economic benefits was not complicated. Most of the cost was labor costs while the cost of materials was not expensive and could be purchased by farmers easily. As a result, it could be considered that this model of agricultural extension had the possibility of practical usage.

When elements of variables of support and building motivation were considered, it was found that the farmers had the opinion that the agricultural extension organizations could of efficiently provide knowledge and support for materials and equipment. Mr. Kam (pseudonym, farmer from Group1) gave his opinion that the public officers had the knowledge and ability to train farmers on the dangers and toxicity of burning and how to reduce burning by utilizing biomass. Mr. Si (pseudonym, farmer from Group 3) said, "The public organizations or organizations under sub-district administrative organizations had the sufficient funds to provide training in many areas."

Mr. Si (pseudonym, farmer from Group 2) said, " Farmers would be able to participate in community stages or workshop training on processing the biomass waste for 1-2 days because it wasn't a lengthy period. For the issue on transportatin, such costs could be deducted from the amount of purchasing corn dust." Mr. Saeng (pseudonym, farmer from Group 3) said, "The government could pay for oil coupons or provide support in other forms, for example, providing some trucks for transporting biomass with a low service charge."

For the chipper forcornbiomass installation, the seminar guidelines werethat the researcher or responsible persons for this project wouldlocate the chipper for corn

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biomass near the location of the husker for the farmers' convenience. Since farmers had to transport their biomass to the location of husker, it would be more convenient for them if the chipper was located at that location, too. In addition, the seminar considered that this would make the process less complicated. Mr. Si (pseudonym, farmer from Group 2) gave his opinion that, " It would be more convenient for farmers if they could mill the husked biomass with the chipper without further transportation. Moreover, the waste of corncobs would not be lost during the transportation."

On biomass being processed for utilization, the farmers had the opinion that the important factors that would enable farmers to process the biomass to corn dust for economic benefits were the farmers would need to understand the methods and practical operation.Also, some suggestions indicated that the training site should not be far from the farmers' farms and the duration of such workshop should only be approximately 1-2 days. Consequently, more farmers would join such workshop. For this issue, Mr. Kam (pseudonym, farmer from Group 1)1 suggested, "The training site should not be far from the farmers' houses. The distance traveled should be within 30 minutes and the farmer should be able to return home the same day for doing other business at their home." Mr. Si (pseudonym, farmer from Group 2) said, "The duration of such training should not be over 2 days. If such training could be finished within one day, that would be preferred. However, it should depend on the difficulty and content of such training." Mr. Kam (pseudonym, farmer from Group 1) had the opinion that, "Such training should emphasize on making farmers understand the principles easily and all tools should be sufficientlyprepared and easy to operate and purchase."

On price, farmers had the opinion that although processed biomass wouldn't be able to be sold or although it earned the low price, this activity still helped to reduce the cost of production.For example, if the corn dust had a low selling price, farmers may not sell the corn dust but process it to be used

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to replace other products such as fermented fertilizer or wood pallet making. On the other hand, if the price of this corn dust was good with sufficient market demand, this project may provide various alternatives of processing to farmers, for example, making as the material for growing mushrooms.

Farmers were able to select the activities related to market demand. Mr. Tao (pseudonym, farmer from Group 1), Mr. Prasop (pseudonym, farmer from Group 2), and Mrs. Saeng (pseudonym, farmer from Group 3) provided that, "We will choose mushroom growing because it could be sold easily at a good profit."

From focus groups, suggestions and answers of farmers could be concluded that the model of agricultural extension to reduce corn biomass burning was the model with a high possibility of practical uses because it was easy and convenient. In addition, farmers were able to follow its methods easily. However, there was one condition, the agricultural extension organizations would need to financially support them on some large devices, e.g, the biomass chipper, and some workshops as well as driving the market for purchasing such processed product.

In the last stage of the focus group, the researcher asked the farmers what guidelineswould be needed for the action research to test the appropriateness of the model of agricultural extension to reduce corn biomass burning. The farmers gave their opinions and suggestions that there should be some guidelines on providing support to the farmers for transporting the biomass left on their farms to the location of the chipper. The researcher should locate the chipper at the same area as the husker and there should be somone controlling such chipper. The workshop should be held at Chong Charoen Farm and the researcher should support the costs of transportation and meals for the farmers participating in this research project. The researcher accepted those suggestions and thanked all participants.

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4.2 Stage 2: Testing Appropriateness of the Model of Agricultural Extension to Reduce Corn Biomass Burning

4.2.1 The results of the quantitative research on testing the model of agricultural extension to reduce corn biomass

In this stage, the researcher applied the methods of the quantitative research by studying the farmers growing corn and participating in the first stage of the community stage. The sample group was one hundred and twenty volunteers participating in the project to test the appropriateness of the model. They were the volunteers from the community stages held in three sub-districts including forty-five volunteers from Mae Na Jorn Sub-District, thirty-five volunteers from Ta Pha Sub-District, and forty volunteers from Chang Kerng Sub-District.

The researcher applied the Experimental Design by choosing the Pre-Experimental Design in the form of One–Group Pretest and Postest Design (Ruj Sirisanyaluck 2001, P 174) as follows: Whereas, O_1= The first assessment before treatment, X = Treatment (The operation of the project utilizing cornbiomass to replace burning consisted of the workshop. The farmers brought the corn biomass from their farms and the collected corncobs to be milled with the chipper for further utilization. O_2 = the second assessment after treatment.

The research site was Chong Charoen Farm which the researcher used as the training venue and each husker location of each sub-district as the location of the chipper. The researcher located the biomass chipper at each husking location in order to enable the farmers to mill the obtained biomass with the chipper, yielding the corn dust at a size of 0.5 mm.that would then be contained in the bags for further utilization. The procedures of the test on the appropriateness of the model of agricultural extension were as follows:

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Stage 1:Collecting Variables Data

Data used in the reseach before treatment (project operation) was data on the primary economic and social characteristics of farmers, their understanding and knowledge of processing the corn biomass for utilization, and their attitudes toward utilization of corn biomass instead of burning it.

The researcher collected data from each group of the three districts as follows:

Group 1: 45 farmers from the community stage set in Mae Na Jorn Sub-District on Friday 3rd October 2014

Group 2: 35 farmers from the community stage set in Ta Pha Sub-District on Monday 6th October 2014

Group 3: 40 farmers from the community stage set in Chang Kerng Sub-District on Thursday 9th October 2014

Stage 2:Workshops on Utilization of Corn Biomass

The researcher provided workshops for one hundred and twenty farmers at Chong Charoen Farm for three days and those farmers were divided into three groups. The duration of each workshop for each group was one day starting from 8:30 a.m. -4:30 p.m., as follows:

Group 1: 45 farmers from the community stage set in Mae Na Jorn Sub-District on Saturday 13th December 2014

Group 2:35 farmers from the community stage set ain Ta Pha Sub-District on Tuesday 16th December 2014

Group 2: 40 farmers from the community stage set in Chang Kerng Sub-District on Friday 19th December 2014

The content of this workshop related to utilizing the corn dust for making organic fertilizer, cow feed, and material for growing mushrooms. The workshop was conducted through lectures and leading the farmers in some experiments and practices. The researcher first gave lectureson each topic (e.g., making of cow feed) before leading the farmers in some experiments

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and practices until they were able to do those practices practically themselves.

Stage 3: The Test on Knowledge of Farmers on Processing Corn Dust for Utilization

This was considered the post- test.

Stage 4: Farmers Brought the Biomass Material to the Location of Husker

The farmers brought their corn biomass from their farms to the location of husker to separate the corn seed. Subsequently, the corncobs, leaves and stems were milled with the chipper to yield the corn dust. Then, the farmers contained the corn dust in some bags or sacks for further utlization. In this stage, the researcher collected data on the quantity of corn biomass transported by the farmers from their farms and the data on the quantity of corn dust of each farmer in units of kilograms.

Stage 5: Farmers Take Corn Dust Back to Their Farms

Farmers took the corn dust back to their farms to utilize in various ways. The researcher collected data on the quantity of corn dust utilized by the farmer and provided some suggestions from the research team.

Stage 6: Collecting Data After Completing Workshop

The data was collected after completing the workshop by asking the satisfaction of farmers towards their participation in the project, acquired knowledge on the utilization of corn biomass, the process and other related factors.

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Results of Analysis on Qualitative Data of Each Stage

4.2.1.1 Stage 1: Collecting Variables Data

After studying one hundred and twenty volunteer farmers who participated in the project to test the appropriateness of the model of agricultural extension to reduce cornbiomass burning, the researcher analyzed the data related to the primary economics and social characteristics of the farmers before treatment or participating in the workshop, the conditions of corn

growing, and the management of cornbiomass to reduce burning.The results of such analysis were presented in the form of table with illustration as follows:

Table 4.1 Some Primary Economic and Social Characteristics of Farmers who Participated in this Research Project (n=120)

Primary Characteristics	Quantity	Percentage
Gender		
Male	72	60
Female	48	40
Age(Years)		
20-30	16	13.3
31-40	15	12.5
41-50	63	52.5
51-60	26	21.7
Minimum = 25 years, Maximum = 60 years, $\bar{x}$ = 45.6 years, S.D. = 4.31 years		
Educational Level		
Primary Education	60	50.0
Secondary Education	40	33.3
Vocational Certificate or Diploma	20	16.7

From the study, it was found that farmers who voluntarily participated in the project utilized the biomass for replacing burning. Some of the primary personal characteristics found werethat 60% of the farmers were male and 52.5% of them ranged in age from41-50 years, followed by 21.7%. with ages ranging from 51-61 years. The average age of the farmers was 45.6 years. After studying the educational levels of farmers, it was found that the

highest level of education of 50.0% primary education, followed by 33.3% finishing secondary education.

Table 4.2 Conditions of Corn Growing of Participating Farmers (n=120).

Conditions of Corn Growing the area of corn growing (Rai)	**Quantity**	**Percentage**
11-20	7	5.8
21-30	31	25.8
31-40	50	41.7
41-50	30	25.0
51-60	2	1.7
Minimum = 10 Rai, Maximum = 60 Rai, $\bar{x}$ = 34.9 Rai, S.D. = 9.11 Rai		
The Quantity of Corn Product (kilograms)	**Quantity**	**Percentage**
10,000 – 20,000	9	7.5
20,001 – 30,000	34	28.3
30,001 – 40,000	51	42.5
40,001 – 50,000	21	17.5
>50,000	5	4.2
Minimum = 10,000 kg., Maximum = 60,000 kg., $\bar{x}$ = 35,900 kg., S.D. = 9.1149 kg.		
Corn Product/Rai (Kilograms)	**Quantity**	**Percentage**
≥800	8	6.7
801 - 900	13	10.8
901–1,000	60	50.0
1,001 – 1,100	26	21.7
<1,100	13	10.8
Minimum = 600 kg., Maximum = 1,200 kg., $\bar{x}$ = 950 kg., S.D. = 7.29 kg.		

Table 4.2 Conditions of corn growing of participating farmers

(Contiued)

(n=12(n

Conditions of Corn Growin	Quantity	Percentage
Income Earned from Corn Distribution		
≤100,000	3	2.5
100,001 – 150,000	26	21.7
150,001 – 200,000	49	40.8
200,001 – 250,000	35	29.2
>250,000	7	5.8
Minimum = 70,000 baht, Maximum = 480,000 baht, $\overline{x}$ = 23,400 baht, S.D. = 9.114 baht		
Management of Remaining Corn	Quantity	Percentage
Burned and left in the farm	14	11.7
Ploughed over on the farm	6	5.0
Left on the farm for natural biodegradation	100	83.3
Management of Corn Cob Left from Husking		
Left at the location of the husker	116	96.7
Utilized for further benefits	4	3.3
Reasons for Corn Biomass Burning	Quantity	Percentage
Easy and convenient for elimination	106	88.3
No ideas for its utilization	14	11.7

Table 4.2 Conditions of corn growing of participating farmers (Continued).

(n=120)

Conditions of Corn Growing	Quantity	Percentage
The Quantity of Biomass Caused by Corn Growing (kg.)		
9,000-18,000	14	11.7
18,001-27,000	30	25.0
27,001-36,000	49	40.8
36,001-45,000	21	17.5
>45,000	6	5.0
Knowledge on Disadvantages Caused Burning by Corn Biomass		
True	110	91.7
No	10	8.3
Received previous suggestions or trainings on corn biomass management to reduce burning		
True	84	70.0
No	36	30.0
Interest in utilizing corn dust (multiple answers)		
For growing mushrooms	92	76.7
For making cow feed	50	41.7
For making fermented fertilizer	45	37.5
For making charcoal briquettes	15	12.5

After studying the conditions of corn growing of the farmers before participating in the project to test the appropriateness of the model of agricultural extension to reduce corn biomass burning, it was found that 41.7% of farmers had a plantation area of corn ranging from 31-40 rai, followed by 25.8% having 21-30 rai, and 25.0% having 41-50rai. The average area of corn growing was 34.9 rai. 42.5% of farmers gained corn products (seed) in the amount of 30,001-40,000 kilograms, followed by28.3%, which gained 20,001 – 30,000 kilograms. The average corn product gain was 35,900 kilograms. After considering the quantity of corn product per rai, it was found that the farmers gained the average corn product gain of 950 kilograms per rai. When considering income earned from corn distribution, it was found that 40.8% of farmers earned income from distributing corn in the range of 150,001-200,000 baht, followed by 200,001 – 250,000 baht by 29.2%. The average earned income from corn distribution was in the amount of 234,000 baht.

For management of remaining corn waste after distributing corn, 83.3% of farmers left the corn stems in their farms for natural biodegradation, followed by 11.7%,who burned it. For corncobs obtained from husking, 96.7% of farmers did not eliminate such corncobs but they left them at the location of the husker. As a result, the researcher asked the farmers why they burnt the corn biomass and 88.3% of farmers replied that they burnt the corn biomass because it was convenient while 11.7% of them replied that they had no idea how to utilize such biomass.

When studying on the quantity of corn biomass caused by corn growing, the researcher conducted an experiment by growing one rai of corn, or 5,000 stems of corn, and found that there was 900 kilograms of corn biomass caused by such growing. The researcher estimated the quantity of corn biomass caused by the corn growing of the one hundred and twenty volunteer farmers by calculating the size of plantation area and the obtained quantity of biomass shown in Table 5. It was found that 40.8% of the farmers that grew corn and caused 27,001 – 36,000 kilograms of corn

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biomass, followed by 25.0% causing 18,001 – 27,000 kilograms of corn biomass.The average amount produced among the one hundred and twenty farmers was 31,410 kilograms of corn biomass.

Moreover, the researcher asked the farmers whether they perceived the disadvantages of corn biomass burning. 91.7% of farmers replied that they perceived those disadvantages.

The researcher further asked whether they previously received any suggestions or training on biomass management. 70% of them replied that they had received some suggestions and participated in some traning on such management. The researcher asked what activities the farmers were interested in after perceiving the model of milling and utilization proposed by the researcher. 76.7% of farmers replied that they were interested in utilizing corn biomass for growing mushrooms, followed by 41.7% interested inutilizing biomass for making cow feed.

Table 4.3 Attitudes of Farmers Toward Corn Biomass Management to Reduce Burning (Before operating the project to test the appropriateness of the model of agricultural extension to reduce biomass burning)

Issues	$\bar{x}$ **(S.D)**	**Meaning**
1. Farmers were unable to avoid corn biomass burning because there was no better method of elimination.	4.14 (0.652)	Agree
2. Related organizations were unable to motivate farmers to reduce or stop corn biomass burning because they are unable to seek a better replacement.	4.11 (0.650)	Agree
3. General people needed to accept the needs of farmers for biomass burning because there was no other way. If they didn't burn their corn biomass, other farmers would.	4.47 (0.501)	Strongly Agree

Table 4.3 Attitudes of Farmers Toward Corn Biomass Management to Reduce Burning (Before operating the project to test the appropriateness of the model of agricultural extension to reduce biomass burning) (Continued).

Issues	$\bar{x}$ **(S.D)**	**Meaning**
4. Biomass burning helped to improve plant's nutrients	4.12 (0.650)	Agree
5. If cornbiomass was not burned, farmers would be able to utilize such biomass for growing mushrooms but they lacked the correct methods.	3.14 (0.910)	Uncertain
6. Formerly, there were no organizations or any person providing any knowledge or support on materials and equipment for managing corn biomass material for utilization.	3.83 (0.938)	Agree
7. You thought that farmers would be unable to process corn biomass for utilizing it on their farms or selling instead of burning.	4.14 (0.652)	Agree
8 If there was the support for promoting knowledge on corn biomass management, materials, and equipment, farmers would be able to reduce biomass burning and utilize it on their farms.	3.62 (0.926)	Agree
9. Farmers were able to assemble together without relying on any organization in managing the processing of corn biomass for utilizing it on their farms or for selling.	3.14 (0.912)	Uncertain

Table 4.3 Attitudes of Farmers Toward Corn Biomass Management to Reduce Burning (Before operating the project to test the appropriateness of the model of agricultural extension to reduce biomass burning) (Continued).

Issues	$\bar{x}$ **(S.D)**	**Meaning**
10. You thought that the procedures of corn biomass processing to replace burning were complex and too difficult for you.	4.47 (0.501)	Strongly Agree
11. Farmers would be able to reduce corn biomass burning in order to help the Thai government save costs of healing some patients caused by pollution from biomass burning.	2.86 (0.677)	Uncertain
12. Farmers did not prefer following the model of agricultural extension promoting utilization of corn biomass to replace burning because it increased their burden and it was complicated.	4.12 (0.652)	Agree
13. Farmers were able to eliminate corn biomass by themselves for utilizing on their farms at a small cost.	2.86 (0.670)	Uncertain
14. You believed that there were some methods for eliminating corn biomass that provided some rewards to farmers without burning biomass.	2.91 (0.80)	Uncertain
15. You were very interested in participating in the project for processing corn biomass for utilization and replacing biomass burning.	3.14 (0.901)	Uncertain
Total	3.67 (0.347)	Agree

Before participating in the project for utilizing corn biomass to replace burning, the researcher measured the attitudes of the one hundred and twenty volunteers toward corn biomass management by using 15 items in an Attitude Assessment Form. Most issues were met with negative opinions or attitudes toward corn biomass management to reduce burning. From the results of analysis on such biomass management, it was found that, the overall picture, farmers agreed) $\bar{x}$ = 3.67(negatively on issues, for example, they agreed that farmers were unable to avoid corn biomass burning because there was no better method) $\bar{x}$ = 4.14). They agreed that farmers would be unable to process corn biomass for utilization on their farms or selling instead of burning. ($\bar{x}$ = 4.14).Importantly, farmers strongly agreed that general people must accept the necessity of farmers burning biomass because there was no other way. If they did not burn their corn biomass, other farmers would) $\bar{x}$ = 4.47(.

In addition, they strongly agreed that the procedures of cornbiomass processing for utilization was too complicated for farmers($\bar{x}$ = 4.47(. Some farmers felt uncertain with the previous opinions. For example, if corn biomass was not burned, farmers would be able to utilize such biomass for growing mushrooms, but they lacked the correct methods) $\bar{x}$ = 3.14). Farmers felt uncertain that they would be able to assemble together without relying on any outside organizations in managing the processing of cornbiomass for utilizing iton their farms or for selling($\bar{x}$ = 3.14(. They also felt uncertain that there would be methods for eliminating cornbiomass without burning ($\bar{x}$ = 2.91), etc.

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4.2.1.1 Workshop on utilizing corn biomass to replace burning

The researcher held workshops for one hundred and twenty farmers who voluntarily participated in the research project to test the appropriateness of the model of agricultural extension to reduce biomass burning at Chong Charoen Farm located in Ban Kard Sub-District, Mae Wang District, Chiang Mai Province. There were three topics of this workshop including

utilizing corn dust to make the material for growing mushrooms, making cow feed, and making fermented fertilizer. The format of this workshop was lectures, practice and mutual discussion. The duration of this workshop was three days and consisting of one group each day. The first group consisted of forty-five farmers, the second group consisted of thirty-fivefarmers, and the third group consisted of forty farmers, respectively. Before conducting the workshop, the researcher tested for any previous knowledge the farmers may have had on processing corn biomass for utilization and replacing burning by using a twenty-five item questionnaire. The answer of each item was either True or False and correct answers would be given 1point with a total possible score of twenty-five points. The results of the pre-test of farmers are shown in Table 7 and Table 8 as follows:

Table 4.4 Knowledge level of farmers on processing corn biomass for utilization and replacing burning.

Knowledge Level	**Pre-workshop quantity (%)**	**Post-workshop Quantity (%)**
High Level (21-25 points)	0.00	49 (39.5)
Moderate Level (15-20 points)	0.00	71 (57.3)
Low Level (Lower than 15 points)	120 (100)	0 (0.0)
Total	120	120
Minimum Score	3	16
Maximum Score	12	24
$\bar{x}$	6.78	20.3
(S.D.)	1.82	1.875

The results of the pre-test and post-test on the knowledge level of farmers on processing corn biomass for utilization and replacing burning showed that all farmers (100%) had knowledge on processing corn biomass for utilization and replacing burning before participating in the workshop, button a low level with the lowest score of 3 pointsand the highest score of 12 points, while the average score was 6.78 points out of 25 possible points.. However, after participating in the workshop on processing corn biomass for utilization, it was found that 57.3% of the farmers now had a moderate level of knowledge on this topic while 39.5% of them had high levels of knowledge on this topic. The average score was 20.3 points, the maximum score was 24 points, and the minimum score was 16 points.

When considering the knowledge of farmers on the 25 issues as shown in Table 8, it was found that farmers obtained the knowledge or gave the right answers before and after the workshop as follows:

Table 4.5 Knowledge of farmers on processing corn biomass for utilization and replacing burning (pre- and post – workshop)

(n=120)

Issues	Quantity of Farmers Giving Correct Answers	
	Pre-Workshop Quantity (%(	Post-Workshop Quantity)%(
1. The appropriate method for milling corn biomass for utilizing as the material for growing mushrooms is milling with 5 ml grinder. (True)	6(4.9)	120(100.0)
2. The size of the grinder of the biomass chipper for making fermented fertilizer or making cow feed should be 10 millimeters for saving fuel cost. (True)	10(8.2)	120(100.0)

Table 4.5 Knowledge of farmers on processing corn biomass for utilization and replacing burning (pre- and post – workshop) (Continued)

(n=120)

Issues	Quantity of Farmers Giving Correct Answers	
	Pre-Workshop Quantity (%(	Post-Workshop Quantity)%(
3. The objective of corn biomass milling is to increase the surface area of biomass for improving the benefits of biomass utilization. (False)	7(5.7)	62(51.7)
4. The objective of biomass milling is to increase the surface area of biomass burning for accelerating burning. (False)	8(6.6)	65(54.2)
5. The appropriate method for milling corn biomass for utilizing as the material for growing mushrooms is milling with 5 ml grinder. (True)	5(4.1)	62(51.7)
6. Biomass milling helps to accelerate the reaction between microbe and biomass improving the efficiency of fermentation due to the increased surface of reaction. (True)	54(55.0)	111(92.5)
7. Corn biomass milling for growing mushrooms is more delicate than biomass milling for making fermented fertilizer or making cow feed. (True)	68(55.7)	109(90.8)

Table 4.5 Knowledge of farmers on processing corn biomass for utilization and replacing burning (pre- and post – workshop) (Continued)

(n=120)

Issues	Quantity of Farmers Giving Correct Answers	
	Pre-Workshop Quantity (%(	Post-Workshop Quantity)%(
8. We are unable to utilize the corn dust for replacing saw dust in growing mushrooms by 100%. (False)	3(2.5)	110(91.7)
9. In making the substrate for growing mushrooms, the temperature of heat generated by steam should not be over 95 degrees Celsius. (False)	4(3.3)	61(51.8)
10. In steaming for sterilizing unwanted microbes, the temperature of such steaming should be higher than 95 degrees Celsius and the duration of steaming should be 4 hours. (True)	23(18.9)	120(100.0)
11. Sterilized substrate is able to be dropped with mushroom spawns without incubation. (False)	107(87.7)	120(100.0)
12. Sterilized substrate is able to be dropped with mushroom spawns after leaving mushrooms to cool for 24 hours. (True)	97(79.5)	120(100.0)

Table 4.5 Knowledge of farmers on processing corn biomass for utilization and replacing burning (pre- and post – workshop) (Continued)

(n=120)

Issues	Quantity of Farmers Giving Correct Answers	
	Pre-Workshop Quantity (%(	Post-Workshop Quantity)%(
13. Aftre dropping substrate, such mushrooms should be kept and overlapped toreacha temperature higher thand 35 degrees Celsius (False)	4(3.3)	120(100.0)
14. The humidity of mushroom cottage should not be over 50%.(True)		
15. If there is any available time, the cover of substrate could be opened without waiting for full growth of substrate. (False)	6(4.9)	120(100.0)
16. The expired substrate is unable to be utilized further. (False)	10(8.2)	120(100.0)
17. Fermented feed made of corn biomass is unable to be fed to ruminants because compound stomach animalsare unable to digest fibers. (False)	60(49.2)	94(78.3)
18. Fermentation of Total Mixed Rations should not be conducted by anaerobic fermentation because large amounts of air is needed for microbes used in this fermentation. (False)	4(3.3)	80(66.7)
19. We are able to improve the nutrients by adding some nutrients mixed with corn dust based on the formula needed for each animal's age. (True)	97(79.5)	106(86.9)

Table 4.5 Knowledge of farmers on processing corn biomass for utilization and replacing burning (pre- and post – workshop) (Continued)

(n=120)

Issues	Quantity of Farmers Giving Correct Answers	
	Pre-Workshop	Post-Workshop
	Quantity (%(	Quantity (%(
20. Utilizing corn biomass for making Total Mixed Ration has a higher cost than the instant feed available in the markets. (False)	9(7.4)	82(67.2)
21. Farmers are unable to make Total Mixed Ration by themselves because it requires high levels of education with complicated procedures. (False)	4(3.3)	90(73.8)
22. Making fermented fertilizer from corn dust requires several months of fermentation. (False)	9(7.4)	95(77.9)
23. Utilizing small corn dust with the size of 10 millimeters could make fermented fertilizer with a duration of fermentation not over 45 days. (True)	9(7.4)	65(53.3)
24. To make fermented fertilizer, the humidity of biomass should be at low levels with no air ventilation in order to prevent decomposition. (False)	34(27.9)	76(62.3)
25. After fermentation, the surface of corn biomass should be a large area in order to accelerate the reaction between microbes and biomass as well as to provide good air ventilation. (True)	90(73.8)	107(89.2)

From testing the knowledge of the one hundred and twenty volunteer farmers participating in the project for utilizing cornbiomass to replace burning based on the twenty-five itemsfrom the questionnaire, it was found

that most farmers were unable to answer all questions correctly before participating in the workshop. It could be seen that less than 50% of farmers could correctly answer eighteen questions , for example, Question No. 1 asking whether the appropriate method for milling cornbiomass for utilizing it as the material for growing mushrooms is milling with 5 ml grinder. There were only six farmers, or 4.9%, who answered this question correctly. For Question No. 5 asking whether biomass milling helps to accelerate the reaction between microbes and biomass. There were onlyfive farmers, or 4.1%, who answered this question correctly. For Question No. 8 asking whether we are unable to utilize the corn dust for replacing saw dust in growing mushrooms by 100%, there were only three farmers, or 2.5%, who answered this question correctly. However, there were seven questions that were answered correctly by over a half of the farmers (50%), for example, Question No. 12 asking whether sterilized substrate is able to be dropped with mushroom spawns after leaving mushroomsto cool for twenty-four hours. There were ninety-seven farmers, or 79.5%, who answered this question correctly. For Question No. 19 asking whether we are able to improve the nutrients by adding some nutrients mixed with corn dust based on the formula needed for for each animal's age, there were ninety-seven farmers, or 79.5%, that answered this question correctly.

After completing the workshop on processing corn biomass, the researcher asked the same twenty-five questions of the farmers again, it was found that most farmers were able to answer the questions correctly. There were eleven questions that could be answered corectly by over 90% of the farmers, for example, Question No 1 asked whether the appropriate method for milling corn biomass for utilizing as the material for growing mushrooms is milling with 5 ml grinder. All 100% of farmers were able to answer this question correctly. For Question No. 2 asking whether the size of the grinder of the biomass chipper for making fermented fertilizer or making cow feed should be 10 millimeters for saving fuel cost. Again, 100% of the farmers were

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able to reply to this question correctly. However, there were five questions that less than 65%, but not lower than 50%, of farmers were able to answer correctly, for example, Question No. 9 asking whether in making the substrate for growing mushrooms, the temperature of heat generated by steam should not be over 95 degrees Celsius. There wereonly sixty-one farmers, or 51.8%, who were able to answer this question correctly.

It could be seen that there were a large quantity of farmers who were able to answer questions correctly after participating in the workshop.

4.3 Stage 3: LessonsLearned Visualizing the Participation in the Experiment of the Model of Agricultural Extension toReduceCorn Biomass Burning

Lessons learned visualizing the participation of one hundred and twenty farmers from the community stages who voluntarily participated in the workshopsheld at Chong Charoen Farm located in Mae Wang District, ChiangMai Province. The researcher divided the workshop into three groups with the duration of one day per group starting from 8:30 a.m. – 4:30 p.m.

Group 1: 45 farmers from the community stage set in Mae Na Jorn Sub-District on Saturday 13th December 2014

Group 2: 35 farmers from the community stage set in Ta Pha Sub-District on Tuesday 16th December 2014

Group 3: 40 farmers from the community stage set in Chang Kerng Sub-District on Frida 19th December 2014

The objective of this workshop was to enable the participants to learn from actual and direct experience in order to obtain new concepts that would be useful in solving the problem of corn biomass burning.

The workshop started with the researcher proposing that the objective of this workshop was to utilize the corn biomass and ensuring that the model would reflect what was mutually created by the participants and researcher during the community stages and focus groups. There could be both disadvantages and advantages of such a model thatcould be improved upon or added to and the participants were asked to give their

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suggestions and opinions. The participants were able to give their opinions and ask some questions while the work commenced from the period of lecturing to conducting the experiments and hands on practice. In addition, they were also able to propose some possible problems that could occur in practical usage and offer comments on how much they understood the proposed data and information.

The researcher started the lecture on milling corn biomass (including corn leaves, stems, and corncobs) with a chipper for yielding corn dust with an appropriate size for utilization. This stage was the key in starting the project. After finishing the first lecture, the following topics were obtaining and utilizing corn dust for making the material for growing mushrooms replacing the saw dust of Para rubbertrees , making fermented fertilizer, and making cow feed.

The lectures were conducted in the morning before lunch break. Subsequently, the practical operation was conducted in the afternoon under the close supervision of the researcher and the research team.

During the morning lectures, the farmers had the following questions:

Mr. Khao (pseudonym, farmer from Group 1) said that,“ we used to participate in this kind of workshop so we understand the content of the lecture but there was no workshop for using the biomass chipper as a tool for milling biomass for further utilization.”

The researcher mentioned that the biomass chipper was a tool used to helpsolve the primary problems ofutilizing the biomass material and farmers should understand the process of operation and the inspection that should be performed daily before the operation. For maintenance, it would be the same as basic maintenance of general engines.

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Mr. A (pseudonym, farmer from Group 3) asked, “Why do we have to mill the biomass to be small dust?”

The researcher replied that milling corn biomass as corn dust was of importancebecause it could be easily be used for utilization. In addition, the size of corn dust could vary depending on the demand of the utilization, for example, for making the material for growing mushrooms, the size of corn dust must be less than 5 millimeters. On the other

hand, for making fermented fertilizer or fermented feed, the size of corn dust should be 10-20 millimeters. This would help to save the cost of milling because it would provide higher amount of corn dust and save the costof oil.

Mr. Nueng (pseudonym, farmer from Group 2) asked, "How to determine the size of corn dust to meet with our demands?"

The researcher replied that it could be determined by changing the grinder inside the chipper. The hole of grinder would specify the size of corn dust and it could be removed and replaced depending on need.

In the afternoon, the researcher started to run the engine to demonstratefor the farmers in the biomass workshop upon suggestion. After obtaining the amount of biomass needed to fill the chipper from the farmers, the process was conducted. From observing and participating in the experiment, farmers considered that this process was not complicated and they would be able to perform such process.

After milling the biomass, the researcher led the workshop to demonstrate and practice utilzing corn dust for three guidelines of agricultural extension including:

4.3.1 Utilizing obtained corn dust for growing mushroomsinstead of using the saw dust from Para rubber

Some nutrients required by mushrooms were prepared for mixing with the corn dust to replce the saw dust of Para rubber. The mixture was mixed well before it was contained in bags, bottle necked for covering. Subsequently, the mixture would be sterilized ata temperature of 100 degrees Celsius for 4 hours. The sterilized substrate was left to cool before dropping in prepared mushroom spawns. Then, the substrate was kept in a mushroom house to grow.

During the cycle of mushrooms grown by corn dust, the trainer provided an opportunity for farmers to ask some questions.

There was a question from Mr. Song (pseudonym, farmer from Group 2) asking whether "biomass is able to be utilized for growing mushrooms without milling"

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The researcher answered that milling enabled the corn dust to grow many types of mushroom. If the biomass was not milled to a small size, the growth of the mushroom fibers may not be good. Although there were some types of mushroom that could be grown on normal corn biomass like Coprinus, milling provided more appropriate conditions for mushroom growing leading to more worthwhile products. As a result, biomass should be milled before utilizing it for growing mushrooms.

Mr. B (pseudonym, farmer from Group 3) asked, "What types of mushroomsshould we grow?"

The researcher answered that the types of mushroom that could be grown easily and that were in demand by markets were oyster mushrooms, pheonix oyster mushrooms, black and white mushrooms, and Russula Delica.

Mr. Dam (pseudonym, farmer from Group 1) asked, whether "the corn dust was able to be utilized for growing other types of mushroom besides those four types?"

The researcher replied that it was possible but the formula of ingredients would need to be prepared to match the demands of each type of mushroom.

Mr. Dam (pseudonym, farmer from Group 1) asked further,"How is this corn dust better than the saw dust of Para rubber trees on plant nutrition."

The researcher replied that the structure of elements of cornbiomass consisted of higher useful nutrients for mushroom, for example, carbohydrates, making mushrooms grown by corn dust possess higher amounts of nutrients.

Mr. Sam (pseudonym, farmer from Group 2) asked, "Why is steam sterilization at 100 degrees Celsius required for 4 hours."

The researcher answered that 4 hours of steam sterilization was considered a complete sterilization because some types of microbes were unable to be sterilized completely at 100 degrees Celsius within 1 or 2 hours. As a result, double time of

continued sterilization was required for complete sterilization.

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Mr. Khao (pseudonym, farmer from Group 1) asked, "Why does the humidity of mushroom house have to be controlled between 50-60%?"

The researcher answered that mushroomsarea living things that are unable to produce their own food and have to eat nutrients from other types of living livings. As a result, humidity is a mechanism that helps to improve the biomass digestion of mushrooms. On the other hand, if the mushroom was not at the proper level, it may affect the growth of mushroom.

Mr. C (pseudonym, farmer from Group 3) asked "How do we manage mushroom diseases and pests?"

The researcher replied that farmers should prepare the mushroom house under shade with good air ventilation and cleanliness. It should not be in an environment that would be considered as a source of diseases. For preparing the substrate, correct sterilization should be conducted at the proper temperature and time of substrate dropping in order to prevent infection. Farmers should not ignore these processes. Letting mushroom get infected and then healed later should be avoided due to high expenses. However, in the event of any unavoidable problems, the cycle of growing should be suspended and the mushroom house should be cleaned and sterilized and left for over one month before starting the cycle again.

Mr. Daeng (pseudonym, farmer from Group 1) asked, whether "there was enough of a market for these products if all farmers were to turn to make this process?

The researcher replied that farmers should plan to find other markets in other areas in order to reduce the marketing risk.

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4.3.2 Utilization of corn dust for making cow feed

This method of utilizing corn dust required mixingsome nutrients as defined by a formula before adding it in a tank for fermentation in order to eliminate air as much as possible. Subsequently, such tank would be covered tightly and left for twenty-one days before using as cow feed. In this stage, the farmers had the following questions:

Mr. Si (pseudonym, farmer from Group 2) asked, whether “this fermented feed is able to be fed to chickens or pigs?

The researcher responded that roughages were used for feeding compound stomach animals. To feed chicken and pork this feed made of corn dust may be possible as a kind of supplement food for chickens and pigs for snacking but it provided no health benefit for growth insuch pigs and chickens. Since the digestive system and microbe utilization of compound stomach animals helped to change the structure of cellulose, ruminants were able to utilize fermented feed better than simple stomach animals.

Mr. B (pseudonym, farmer from Group 3) asked, “How do we make sufficient fermented food for daily utilization.”

The researcher replied that it was necessary to start the calculation from the quantity of animals. The total weight of such animals should be included to find the total weight of demanded food. Subsequently, the fermented feed shall be made for such weight to be eaten daily. If any farmer wanted to spare such food for week, they would have to make seven times the quantity.

Mr. Song (pseudonym, farmer from Group 2) asked,whether “the fermented feed would be rotten if it was not used completely after its cover was opened?”

The researcher answered that if such feed was not used completely wihin seven days, it would rot. As a result, fermented feed should be made consistent with actual demands.

Mr. D (pseudonym, farmer from Group 3) asked, “How would we know whether such fermented feed is rotten or good?”

The researcher replied that it could be checked physically, i.e., the odor of fermented feed was normally good without any bad smell and dark color. The color of good fermented feed should be yellow and soft and tender in consistency.

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Mr. Nueng (pseudonym, farmer from Group 2) asked,whether “could fermenting the cornbiomass without milling be possible?”

The researcher replied that it could be possible to make fermented feed without milling but milling helped to improve the efficiency of fermentation. As a result, the obtained feed would be better for animals. Moreover, management of fermentation was easier and more convenient therefore milling should be performed before fermentation.

Mr. Nueng (pseudonym, farmer from Group 2) asked further,whether “this feed could be fed to goats?”

The researcher answered that this feed could be fed to all types of compound stomach animals. As a result, if fresh grass was rare in any dry season, this feed could be used as roughage for feeding goats.

Mr. Kiew (pseudonym, farmer from Group 1) asked,whether “this fermented feed would affect cowfouling?”

The researcher replied that fouling depended on the sexual maturity of animals. Lack of food or abnormal growth of animals may affect their reproductive system leading to such problems. Fermented feed was better for animals because it provided sufficient nutrients. As a result, feeding fermented feed to animals gave no ill effect to their yearlings.

Mr. A (pseudonym, farmer from Group 3) asked, “How do we make fermented feed for increasing an animal’s weight? ”

The researcher answered that mature cows that were suitable for distribution should weigh over 400 kilograms. A way to increase their weight before distribution was by adding concentrated feed during the last 6 months before distribution. Such concentrated feed could be prepared by adjusting the formula of fermented feed. The quantity of concentrated feed should be 2 – 3% of cow’s weight and fermented feed should be fed fully in order to save meal costs and increase the cow’s weight.

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4.3.3 Utilization of corn dust for making fermented fertilizer

Mr. Sam (pseudonym, farmer from Group 2) asked, “Why couldn’t corn biomass be made into fermented fertilizer directly without milling?”

The researcher said that making fermented fertilizer without milling was previous promoted by farmers, but it was ineffective. As a result, this problem was studied and improved upon to obtain the results as suggested, i.e., milling should be performed before

using corn biomass to make any fermented fertilizer because it helped to make management and transportation more convenient as well as helped to save costs and gained a higher quality fertilizer.

Mr. C (pseudonym, farmer from Group 3) asked,whether“this obtained fertilizer could be used with Para rubber tree?”

The researcher replied that it was possible because this fermented fertilizer was made of 25% manure mixed with micrbes for digesting the biomass rapidly. The main nutrients that were useful for plants were nitrogen, phosphorus, and potassium. Itwould be able to be used as the fertilizer or food of Para rubber trees however, to gain good quality of rubber latex, additional nutrients would need to be added upon the demands of Para rubber trees in each area.

Mr. Daeng (pseudonym, farmer from Group 2) asked,“How much cost of fertilizer would this fermented fertilizer help to reduce?”

The researcher replied that the current cost of fertilizer for corn growing was approximately 500 baht per rai. The cost of fermented fertilizer making was 3.50 baht per kilogram and the rate of utilization at 100 kilograms per rai calculates to be 350 baht. As a result, farmers would receivea discount by replacing chemical fertilizer with fermented fertilizer in the amount of 150 baht per rai. Although the quantity of their products would be the same, the quality of soil would be better if it were continued consecutively each season. For any plantation area using chemical fertilizer would yield lower

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products long-term while the plantation area using organic fermented fertilizer had a better tendency of providing more products in long- term.

Mr. Dam (pseudonym, farmer from Group 1) asked,whether there is any "limitation of manure in making fermented fertilizer?"
The researcher replied that the large quantity of manure neededto be mixed with cornbiomass was possible because of all the industrial animal production in today world, for example, dairy cattle breeding, chicken breeding, and pig breeding. As a result, it was possible to supply large amounts of manure for making fermented fertilizer. More information could be required from the local sources of livestock production or any agency of Department of Livestock Development.

Mr. Si (pseudonym, farmer from Group 2) asked, "How much does the chipper cost and where do we acquire it?"
The researcher replied that the chipper with the capacity ofproducing 1,000 kilograms per hour cost 500,000 baht per set and it could be acquired by contacting the Chong Charoen Green Energy Company Limited located in Mae Wang District, Chiang Mai Province, Tel 081-8837585.

Mr. Daeng (pseudonym, farmer from Group 1) asked, whether "there is any organization helping to supply the chippers to farmers for milling biomass, because the cost of the chippers was quite high for farmers."
The researcher replied that farmers would be able to utilize one common chipper installed on a trailer for moving to several locations therefore it would be convenient for farmers. As a result, farmers could mutually invest and purchase the chipper for their group. However, if they required some supoort from the public organizations, they could asktheir local administrative organizations such as sub-district administrative organizations holding the budget for support for the solution of corn biomass burning.

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From the workshops and discussions with farmers, some data was obtained from lessonslearned showing that participating farmers had some changesin their knowledge and way thinking on management of corn biomass. After completing the workshop to test the model of agricultural extension to reduce corn biomass burning, the researcher thanked all participating farmers for their interest and time given to participate in this project and asked them to cooperate in expanding their newly obtained knowledge and experiences to other farmers. In addition, all participating farmers were also asked to take practical action with obtained knowledge and experiences for three months and they were also asked to record the information of milling and chipper operation upon forms distributed by the researcher. Subsequently, the researcher and research team would intermittently visit and follow up with them.

Table 4.6 The Quantity of Corn Dust that the Farmers Obtained from Milling Corn Biomass Material (Corn Cobs,Leaves and Stems)

(n=120(.

Quantity of Corn Dust(Kilograms)	Quantity	Percentage
≤ 8,000	2	1.7
8,000-16,000	6	5.0
16,000-24,000	34	28.3
24,001-32,000	53	44.2
32,001-40,000	25	20.8

Minimum = 6,000 kilograms, Maximum = 40,000 kilograms, $\bar{x}$= 26,848.35 kilograms, S.D. =6.973 kilograms

The quantity of corn dust obtained from those two stages, i.e., the first stage was corncobsremaining after husking and milling with the chipper and the second stage was bringing the leftover corn leaves and stems from farmers' fields to mill with the chipper at the location of the husker. Farmers made agreements with the voluntary farmers that theywould record the data on the quantity of corn dust obtained from milling corncobs and the quantity of corn dust obtained from milling corn stems and leaves. The researcher designed the record form of such corn dust for the farmers and asked for their cooperation to record the data on the quantity of corn dust for every milling from the chipper. All farmers must record from the first milling until all amounts of corn dust were removed from the farm.

The quantity of corn dust could be clarified based on the results of data analysis recorded by the one hundred and twenty farmers as shown in Table 9. It could be seen that 44.2% of the farmers were able to produce 24,0001 – 32,000 kilograms of corn dust by using the chipper, followed by 28.3% producing 16,001 – 24,000 kilograms.The average corn dust that could be produced by the chipper was 26,848.35 kilograms. This porduced corn dust would be utilized in growing mushrooms, making cowfeed, and making fermented fertilizer.

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Table 4.7 Percentage of Corn Biomass Milled as Corn Dust

n=120.

Quantity of Corn's Biomass Milled as Corn Dust (Percentage)	**Quantity**	**Percentage**
61-70 %	2	1.7
71-80 %	8	6.7
81-90 %	107	89.2
Minimum = 61.37 %, Maximum = 89.74 %, $\bar{x}$ = 88.5 %, S.D. = 4.155%		

The researcher studied the percentage of corn biomass, caused by corn growing, that was milled as the corn dust by calculating the following formula:

$$\% = \frac{\text{Quantity of Milled Corn Biomass (Kilograms)} \times 100}{\text{Quantity of Biomass Caused by Corn Growing (Kilograms)}}$$

From data collected from one hundred and twenty farmers, it was found that the frequency of percentage of biomass caused by corn growing that was milled as corn dust as shown in Table 10 could be explained as follows: 89.2% of the farmers were able to mill corn biomass obtained from corn growing to corn dust for further utilization or selling. As a result, it could help to reduce or eliminate biomass burning and it could be utilized upon such percentage.

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Stage 4: Utilization of Corn Dust of Participating farmers

This stage was following – up with the farmers after participating in the workshop and milling the biomass material from the farms with the chipper, containing it in bags or sacks, and utilizing on farms. The researcher visited the farmers to follow up on their activities of utilizing corn biomass as well as provided some suggestions or answered their questions.

The researcher collected data on the quantity of corn dust for utilization and measured the attitude towards corn biomass management for reducing burning and the satisfaction of farmers after participating in the project. The results of data analysis were show in Table 11.

Table 4.8 Utilization of Corn Dust of Farmers

n=120

Utilization	Quantity	Percentage
Growing Mushrooms	55	45.8
Making CowFeed	5	4.2
Making Fermented Fertilizer	10	8.3
Growing Mushrooms + Making Cow Feed+Fermented Fertilizer	5	4.2
Growing Mushrooms + Making Cow Feed	15	12.5
Growing Mushrooms + Making Fermented Fertilizer	20	16.7
Making Cow Feed+Fermented Fertilizer	10	8.3

After bringing the corn dust back to their farms, the researcher followed up on how the farmers utilized such corn dust and it was found that 45.8% of farmers utilized the corn dust for growing mushrooms, followed by 16.7% that were growing mushrooms and making fermented fertilizer, followed by 12.5% growing mushrooms and making cow feed. Most farmers utilized such corn dust for growing mushrooms. There was only afew farmers that utilized the corn dust for making cow feed, only4.2%.

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Table 4.9 Proportion of Utilized Corn Dust

n=120

Utilization of Corn Dust	Quantity	Percentage
¼ of existing quantity	10	8.3
½ of existing quantity	20	16.7
¾ of existing quantity	50	41.7
Total quantity	40	33.3

The researcher asked for cooperation from the participating farmers to record the data on the quantity of utilized corn dust in every utilization. In this data collection, the the researcher scheduled the duration of data collection for three months starting from the placement of the chipper at the location of the husker. From the results of analysis on the quantity of utilized corn dust of the one hundred and twenty farmers, it was found that 41.7% of the farmers utilized ¾ of the exsiting corn dust, followed by utilizing total quantity of existing corn dust (100%). There were only 8.3% of the farmers utilizing only ¼ of existing corn dust.

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Table 4.10 Visiting of Research Team for Providing Some Suggestions

Visiting	Quantity	Percentage
Being visited by research team		
No	0	0
Yes	120	100
Suggestions given by research team		
No	0	0
Yes	120	100
Level of Satisfaction Towards Visits and Suggestions of Research Team		
High	100	83.3
Moderate	20	16.7
Level of demand for receiving some support and suggestions from research team on self-utilization of corn dust		
High	**5**	4.2
Moderate	25	20.8
Low	90	75.0
Problems on Utilization of Corn Dust		
No Problem	55	46.0
Inappropriate Substrate Growth	20	16.7
Lacking of Labor (for makingfermented fertilizer)	30	25.0
Large Quantity of Remaining Product (AnimalFeed) Due to Small Quantity of Cows	15	12.3

When asked the farmers about the visits and suggestions provided by the research team, all farmers answered that they were all visited by the research team and they also received some suggestions from the research team. When askedabout the satisfaction level of the visits and suggestions provided, 83.3% of the farmers answered that they were greatly satisfied with the suggestions provided by the research team. When askedabout their demands for support provided by the research team, most farmers, or 75.0% of them, answered that they had low demand for suggestions and there were only 5% of them that required such suggestions. When asked about problems that occurred during utilization of corn dust, it was found that 25% of them had the problem of lack of labor in making fermented fertilizer while 16.7% of them had the problem of improper growth of substrate. In addition, 12.3% of them had the problem of large aamount of remaining cow feed due to a small amount of cows.

Stage 5: For data collection after, the researcher asked one hundered and twenty farmers about their attitudes toward corn biomass management to reduce burning and their satisfaction towards participation in the project for utilizing cornbiomass for replacing burning. The results of data analysis were shown in Table 14 as follows:

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Table 4.11 Attitudes of Farmers Toward Corn Biomass Management for Reducing Burning (after operating the Project for Utilizing CornBiomass for Replacing Burning)

n=120

Issues	$\bar{x}$ **S.D.**	**Meaning**
1.Farmers are unable to avoid corn biomass burning because there is no better method for eliminating.	1.86 (0.341)	Disagree
2.Related organizations are unable to motivate farmers to reduce or stop corn biomass burning because they are unable to seek for better replacement.	2.12 (0.370)	Disagree
3.General people must accept the necessity of farmers to burn biomass because there is no other way. If they do not burn their corn biomass, other farmers would do.	2.01 (0.242)	Disagree
4.Biomass burning helps to improve plant's nutrients	2.05 (0.482)	Disagree
5.If corn biomass is not burned, farmers would be able to utilize such biomass for growing mushrooms but they lack correct suggestions and methods.	4.00 (0.01)	Agree
6.Formerly, there was no organization or any person providing any knowledge and support on materials and equipment for managing corn biomass material for utilization	1.99 (0.091)	Disagree 1.99

Table 4.11 Attitudes of Farmers Toward Corn Biomass Management for Reducing Burning (after operating the Project for Utilizing CornBiomass for Replacing Burning)

n=120

Issues	$\bar{x}$ **S.D.**	**Meaning**
7.If there was the support on promoting knowledge on corn biomass management, materials, and equipment, farmers would be able to reduce biomass burning and utilize on their farms.	2.00 (0.020)	Disagree
8.Farmers are able to assemble together without relying on any organization in managing the processing of cornbiomass for utilizing on their farms or for selling.	4.18	Agree
9.Farmers are able to assemble together without relying on any organization in managing the processing of corn biomass for utilizing on their farms or for selling.	4.00 (0.010)	Agree
10.You think that the procedures of corn biomass processing for replacing burning are complex and too difficult for you.	1.47 (0.501)	Strongly D
11.Farmers are able to reduce corn biomass burning in order to help the Thai government to save cost in healing some patients caused by pollution from biomass burning.	4.00 (0.021)	Agree

Table 4.11 Attitudes of Farmers Toward Corn Biomass Management for Reducing Burning (after operating the Project for Utilizing CornBiomass for Replacing Burning)

n=120

Issues	$\bar{x}$ S.D.	Meaning
12. Farmers do not prefer following the model of agricultural extension promoting utilization of corn biomass to replace burning because it increases their burden and it is also complicated.	1.40 (0.492)	Strongly Disagree
13. Farmers are able to eliminate cornbiomass by themselves for utilizing on their farms with small cost .	4.00 (0.002)	Agree
14. You believe that there are some methods for eliminating corn biomass providing some rewards to farmers without burning any biomass.	4.02 (0.128)	Agree
15. You are very interested in participating in the project for processing corn biomass for utilization and replacing biomass burning.	4.06 (0.235)	Agree

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participating in the project for utilizing corn biomass to replace burning, it was found that their attitudes toward all issues were different from those given by them before participating in the project, i.e., farmers disagreed with all negative issues on utilizing biomass for replacing burning and they had the attitudes of agreeing with the positive attitudes of utilizing corn biomass for replacing burning. For example, attitude of Item No. 14, it could be seen that farmers strongly agreed that there were some methods for eliminating corn biomass providing some rewards to farmers without burning anybiomass($\bar{x}$= 4.02) as well as attitude of Item No. 9, farmers agreed that farmers were able to assemble together without relying on any organizations in managing the processing of corn biomass for utilizing on their farms or for selling($\bar{x}$= 4.0). On the other hand, farmers strongly disagreed with attitude of Item No. 10 stated that the procedures of corn biomass processing to replace burning were complex and too difficult for farmers($\bar{x}$= 1.47).When considering the overall attitudes toward all issues that were negative against utilizing corn biomass for replacing overall, most farmers felt uncertain with those questions($\bar{x}$= 2.87).

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