CHAPTER 4

RESULTS AND DISCUSSION

4.1 Transformation from chemical to organic farming

This topic discussed farming context, farmers' utilization of various production practices and transformation into organic vegetable farming. Based on farmers' group discussion and surveyed, there were processes in the vegetable production practices: land clearing, ploughing, planting, fertilizing, pest and disease control, weeding, pruning, and harvesting. Farmers' experience in production practices is slightly different in each community. The results are as follows:

The transition from conventional farming to organic one requires numerous changes. The process of changing into organic farming was found to be quite different from one studied area to another, yet similar in terms of gradual reduction in chemical use. Phrao District has the longest history of organic production beginning in 1995 when farmers got a mindset change after receiving training from an NGO. In Mae Taeng district area where farmers produced mainly cash crops but they tried to minimize the use of chemical fertilizer and insecticide and had adapted their practices organic into thier farming since 1997. Meanwhile farmers in Samoeng district area switched to organic farming from the financial point of view as it made to go organic to avoid the risk from financial disaster since 1995. The detail was discussed below:

Phrao District

Concerns over environmental degradation, natural resource depletion, human health risks, and economic decline associated with commercialized agriculture have led to the emergence of alternative, low-input farming practices in fertilization and pest management. Organic farming methods typically use a blend of traditional practices and ecological principles to enhance the long-term sustainability of agro-ecosystems while maintaining productivity and short-term profit. To support farmers

to transit to alternative production methods, information on organic and low-input farming obtained from long-term field studies is needed to convince them the importance of food safety and health issues and make them believe that organically produced foods are safer than conventional products.

Early 1995, organic agriculture movement began despite farmers' engagement in commercialized farming. In 1996, an NGO Foundation, Young Men's Christian Association (YMCA), organized a training forum on the concept of organic farming for various local communities in Namphare sub-district, Chiang Mai Province. The farmers in more than 30 families who attended this workshop gained more knowledge and understanding about organic farming which they could work in the form or combination of reducing reliance on external factors, crop rotation, and integrated farming of fruit trees and animal husbandry.

In the year 2002, 11 farmers tried to promote and expand the membership of their organic vegetable production group and helped train the new members in the areas of practical training, organic farming concepts, study tour to successful organic farms, techniques to develop organic farms, and visit to other organic vegetable farms within the "Dok-Kum-Tai organic group". The group joined the Club for Organic Production in Chiang Mai which was established to support sustainable agriculture among small farmers.

Nowadays, members of this group are producing organic rice in a total area of nine acres and the group also owns a mill. The members have to pay 2 baht per kg for rice milling. They grow various varieties of rice such as Homnil rice, Red Hom Mali rice and Japanese rice with the seeds obtained from the Chiang Rai Rice Research Center.

Since farming in this area generally is of small scale, new comers in organic agriculture must have attractive price of outputs from the new organic farming patterns as their incentive while those farmers having more than 10 years' experience already had their production pattern well established in the form of integrated system. With the practice of on-farm nutrient recycling to ensure markets the organic features of their produce, organic farmers became able to save cash cost for buying external inputs as well as earn additional market value for their outputs and hence they eventually got higher household income. However, at the time of the present writing,

most of the organic produce is still destined to local market or niche market known to and accessible by health conscious consumers. It is worth to note that organic rice production in particular has brought back the embededness in rural life with lesser market activities and influence in decision making because farming households consume the rice they grow and farmers select the rice varieties they reckon to have good quality traits desired by both family members and consumers in the market. Therefore, farmers in general will choose varieties of rice having high nutritional value and suitable for processing into brown rice and germinated rice for further value addition.

Organic farmers depend on raising animals for manure, growing beans, clover, or other nitrogen-fixing legumes, or making compost and other sources of fertilizer that cannot be manufactured in a chemical plant but are instead grown-which consume land, water, and other resources. (In contrast, producing synthetic fertilizers consumes massive amount of petroleum). Since organic farmers do not use synthetic pesticides, one can imagine that their fields suffer from a scourge of crop-munching bugs, fruit-rotting blights, and plant-choking weeds. And because organic farmers depend on rotating crops to help control pest problems, the same field won't be planted to corn or rice or some other staples as often (Table 4.1).

Mae Taeng District

The organic agricultural producers group in Mae Taeng District was organized among those farmers who determined to produce clean food without harmful chemical use throughout the production process. Historically, members of this group have gone through several phases of the so-called agricultural development from subsistence farming to commercialized agriculture and finally to organic production which is prevailing at present. In the recent past when input-intensive monoculture and market-oriented agricultural production were the fundamental concepts for agricultural economic development, these farmers adopted such mono-cropping systems in different growing seasons as rice, soybean, tobacco, maize, and vegetables, and applied various agrochemicals including fertilizers, pesticides, weedicides, and plant hormones to increase farm productivity. Inadvertently, perhaps, such “modern” farming methods appeared to create a multitude of negative impacts on the farming

households and the environment both locally and externally. Farmers felt the growth in their indebtedness and the worsening of their physical health, as well as the degradation of natural resources particularly the soil fertility and other desirable soil properties for farming. With such problems and bitter experience, some farmers began to explore the ways out and this marked the beginning of their forming into a common problem-ridden solving group.

In 1993, the Mae Taeng District Organic Agricultural Produces' Group was conceived by the support of an NGO that had primary concerns about the livelihoods of farmers at the grassroots level and the deterioration of natural resources consequential to farmers' intensive use of agrochemicals to improve their agricultural productivity (Table 4.1). This NGO took the human development approach by encouraging the rural farmers to learn about themselves, to understand their own problems and the genesis of their problems, and to be aware of their own capacity in handling various problems themselves. The rural farmers might be able to find appropriate solutions to their difficulties and to lead themselves toward a better quality of life. Consequently, the farmers were encouraged to form themselves into an interest group to strengthen their own as well as the group's capability and to push forward an efficient self-development process. In the early stage of forming the organic agricultural producers' group, a training session on concept and practices of organic agriculture was arranged to enable the farmers to make synthesis on the problems and solutions and to get their ideas crystallized themselves. The sufficiency economy philosophy was also an important element to encourage the farmers to appreciate the production for home consumption first before selling the surplus to market, and the cultural practices on the basis of bio-diversity and no harm to natural resources and the environment. Once the farmers had got the concept of organic agriculture and believed that this would be an exit for them to escape from vicious circle they used to experience before, they had to learn how to do organic farming in practice and then apply at the actual farming scale to get the expected outcomes.

Farmers may use many strategies to achieve acceptable economic pest management and high yields. During the transition of knowledge period, weed management can be enhanced through cultural and chemical practices, while insect

management will depend on cultural and biological control methods. Disease management will be based on strategies having an ecological basis.

Form of organic farming in Mae Taeng District is an integrated organic production. Its main activities include the rice farming, vegetable crops and livestock such as cattle and chickens, which can be categorized into four types as despicted in Figures 6,7,8,9:

1) Integrated organic farming within household compound. This system is practiced where farmland and homestead are on the same piece of land. The whole area will be partitioned into land for housing, rice cultivation, chicken, swine, and cattle raising pen and den, pond or fish pond, vegetable growing, and fruit trees in area between vegetable plots and the fence. The fencing area is also planted to a variety of climbing plants for food or medicine.

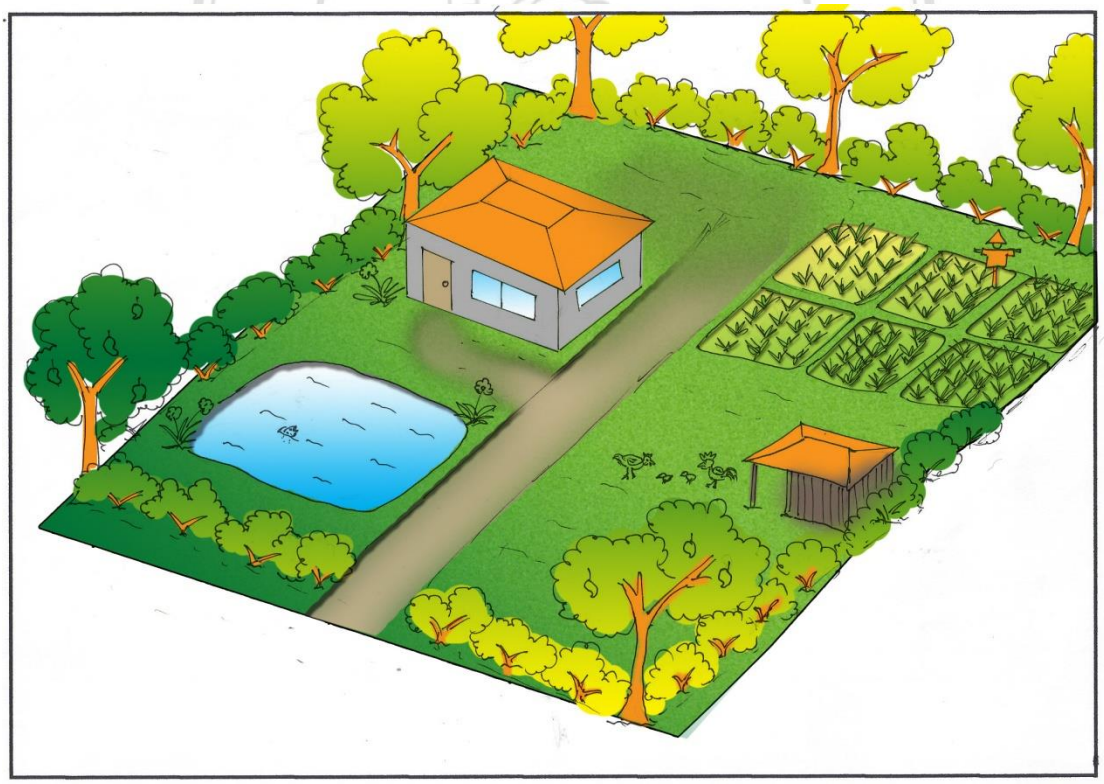

Figure 7 Integrated organic vegetable production within household compound.

2) Organic farming in the plain area. Mixed farming system is predominant in the lowland area. The varietal mix is intended for reciprocal relationship. The paddy field in rainy season is devoted for organic rice growing, and then planted to such leguminous crops as soybean, peanut, and red kidney bean after the rice harvest. Vegetables may be grown after rice or planted in other areas in combination with various fruit trees. Livestock are allowed to roam freely and graze on farm field. In some farms, there is a pond for farm watering or fish raising.

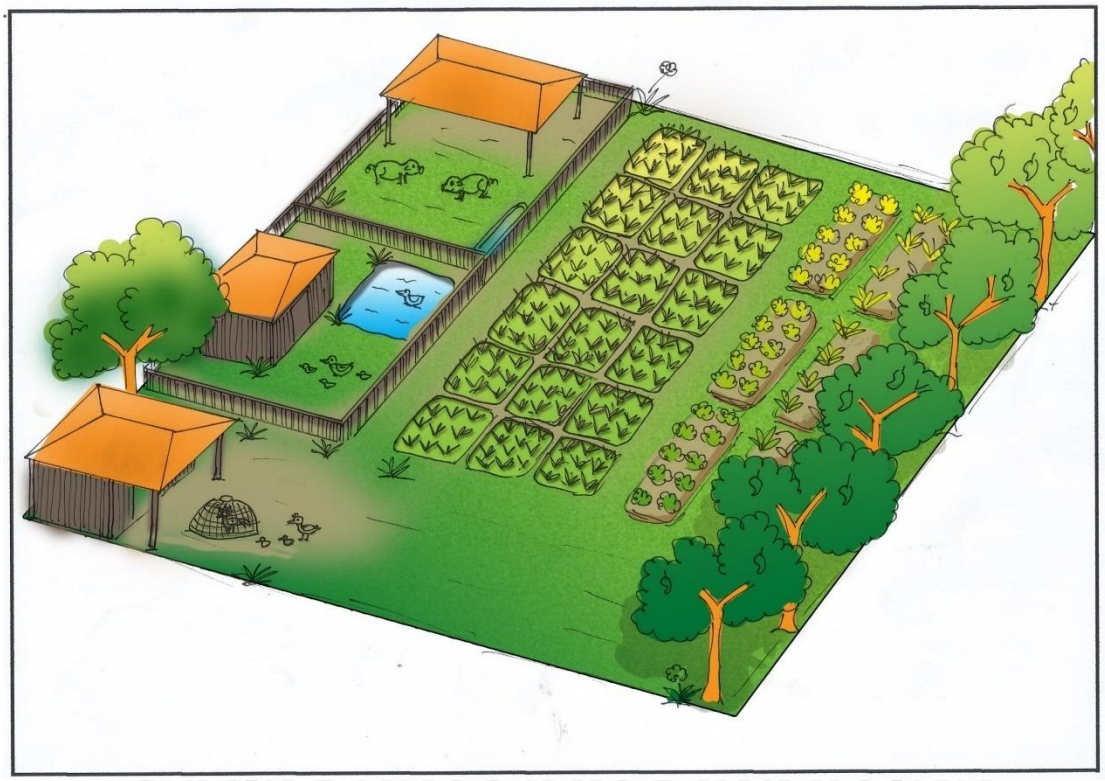

Figure 8 Organic vegetable production in the plain area.

3) Organic farming in upland area. The upland fields include the edge of paddy or orchard and the wild shrub area, mostly located near the village community, at the elevation higher than paddy land and natural water body and in some cases the flat plain at the foothill area. Farming is rain-fed and supplemented by water from natural stream which must be first drawn for storage in pond or tank before use for irrigation. The sustainable organic farming system in the upland is the mixed fruit trees planting due to the limited water resource. However, it is possible to plant Chinese vegetable crops or various native vegetables between rows of fruit trees as

well as raise such livestock as cattle, buffalo, and chicken to benefit other sub-systems in the farming.

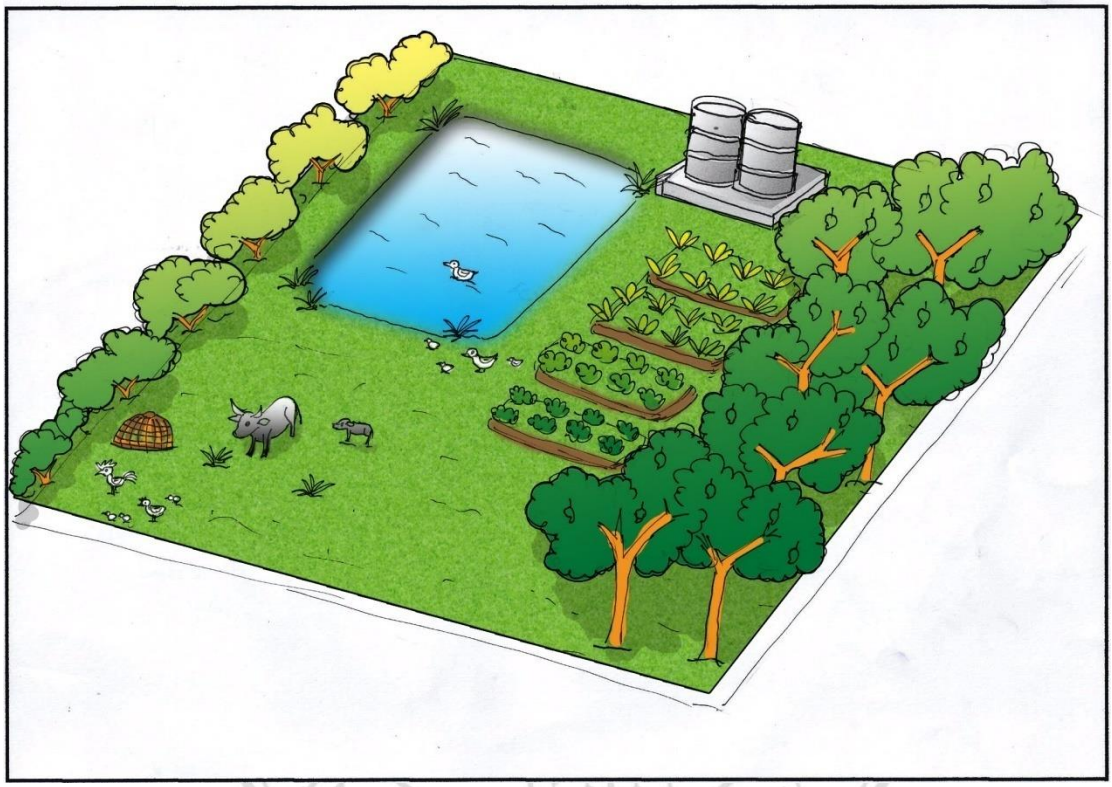

Figure 9 Organic vegetable production in upland area.

4) Organic farming in the highland area. The farm fields are located in areas ranging from the foothill to the mountain top and thus are often quite sloping, with relatively cooler climate. The organic farming system here is of agro-forestry type allowing the co-habitation of human, wildlife, and forests. Upland crops and temperate fruit trees can be incorporated in the forested area in multi-storey form or as undergrowth while various Chinese kinds of vegetables and native edible plants can be grown all year round if there is water resource available nearby.

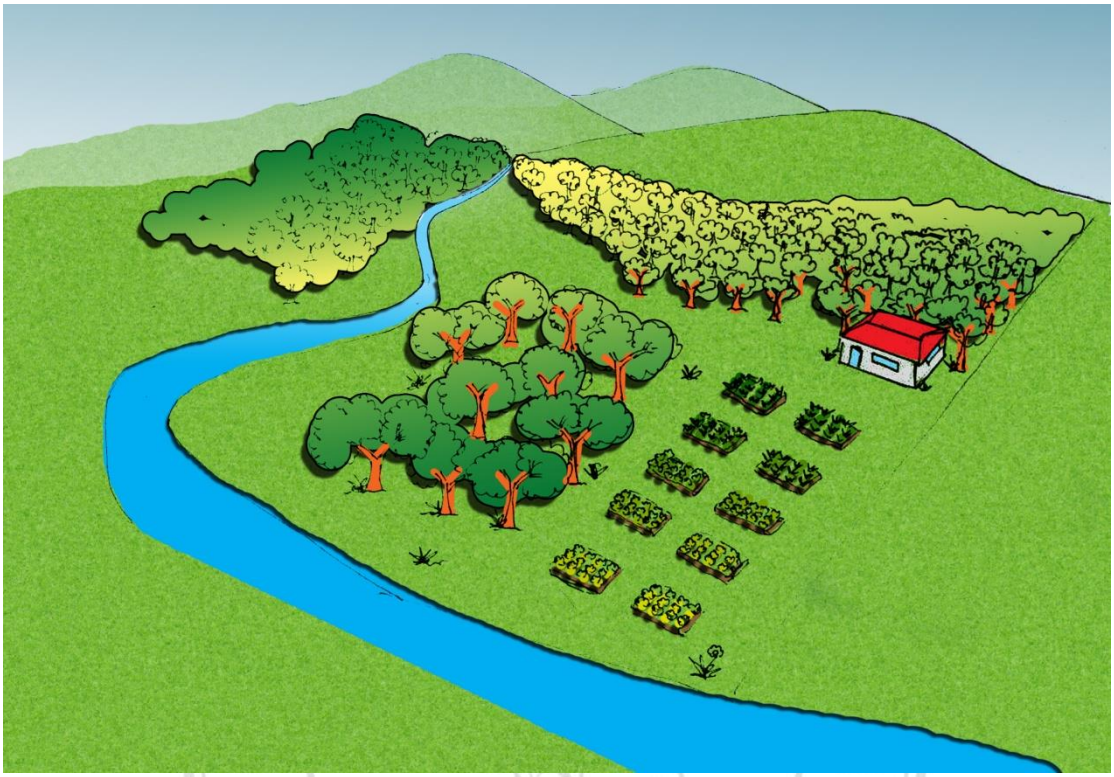

Figure 10 Organic vegetable production in the highland area.

Samoeng District

Organic production has been practiced in Samoeng District since the late 1995. The biggest challenge that farmers face is changing their thinking. Most current organic farmers switched to organic before there were financial incentives. They had environmental concerns. There are not many farmers from that segment left. Most farmers transitioning to organic today do it for financial incentives, which is fine. But they have to adopt the organic philosophy and mindset. Otherwise it will be difficult for them to make it through the three-year transition to organic. Many farmers whose transition based on economics alone don't last two or three years because there is not enough motivation for them to last. But it is often not until the fourth and fifth years when the real transition in the mind of the farmer happens. From a financial point of view it makes sense to ease into organic and not risk financial disaster. The problem is farmers cannot change approach or mindset to organic if they're still farming

conventionally. They would not open to organic solutions to pest control if they are still spraying pesticides.

Some benefits farmers will start noticing on their land during the transition are that the soil becomes softer with less compaction, an increase of beneficial insects and bird populations, and weeds, although present, do not affect crop yields in the way you might expect. Financially there will be less pressure from financing input costs, and the net income tends to be higher in relation to input cost than in conventional farming (Table 4.1).

Table 4.1 Summary of transformation period in vegetable production of the studied areas

Detail/Area	Phrao	Mae Taeng	Samoeng
Past (1995-20005)			
1. Reason for change	Health	Health/Media	Health/Debt
2. Group member	11 HH	35 HH	5 HH
3. Land tenure	Rent/own	Rent/own	Rent/own
4. Planting area	Plain	Slope	Upland
5. Seed	Buy	Buy	Buy
6.Farming systems	Monoculture	Monoculture	Monoculture
7.Market management	Individual	Individual	Individual
8.Market place	Middleman	Contract farming	Middleman
9. Organization support	-	-	-
10. Products	Rice, vegetable	Longan/vegetable	Strawberry, vegetable
11. Harvest	Hand	Hand/knife	Hand
12. Organic training	Organic practice	Bio-fertilizer	-
Transition period (2001-2010)			
1. Reason to change	Insecurity problem	Environment/health	Debt/health
2.Group member	19 HH	23 HH	20 HH
3. Land tenure	Share/own	Rent/own	Rent/own
4. Soil preparation	Tractor	Tractor	Tractor
5. Seed	Collected/free	Collected/buy	Collected/buy/free
6. Farming systems	Integrated	Integrated	Integrated

Table 4.1 Summary of transformation period in vegetable production of the studied areas (continued)

Detail/Area	Phrao	Mae Taeng	Samoeng
7.Market management	Group	Group	Group
8. Market place	JJ market	JJ market	JJ market
9.Organization support	NGO, YMCA, Numphrae municipality	NGO	NGO
10. Products	Rice, Banana, Vegetable, Groundnut	Chili, Rice, Vegetables	Strawberry, Stevia rebaudiana flowers, Chrysanthemum tea, Chinese vegetables
11. Harvest	Hand	Hand	Hand
12.Certification	NOSA	NOSA	NOSA
13. Organic training	Organic practice	Organic practice/bio extract	Organic practice
Current period (2011-2013)			
1. Group member	27 HH	68 HH	27 HH
2. Land tenure	Rent/own	Rent/own	Rent/own
3. Planting area	Plain	slope	Upland
4. Seed	Buy/collect	Buy/collect	Buy/collect
5.Farming systems	Integrated	Integrated	Integrated
6.Market management	Group	Group	Group
7.Market place	Individual/ middleman	Individual/ middleman	Individual/ middleman
8.Organization support	NGO/cooperative	NGO/cooperative	NGO/cooperative
9. Products	Rice, vegetable	Longan/vegetable	Strawberry, vegetable
10. Harvest	Hand	Hand/knife	Hand
11. Organic training	Organic practice	Organic practice/bio extract	Organic practice

Source: Focus group discussion, 2013

4.2 Organic production practice

Farmers in the three studied areas had experience in organic vegetable production in the aspects of land preparation, seed, type of crops, planting method, soil nutrient management, pest management, weed management and harvesting.

Phrao District

1) Land preparation

The majority of farmers often use two-wheel tractors to plough the soil. Some small-scale farmers hired a tractor to plough their fields. Tractor is faster in ploughing than draught animals, but it needs a larger area to be profitable. Tractor ripping produces better results in heavy soils and large area. Land preparation by hand loosens the top soil and gets rid of the weeds. Implements drawn by animals and tractors can penetrate more deeply into the soil and can do a better job of preparing the land. They can really plough it.

2) Seed

Farmers obtain some seeds from organization support and NGO such as rice seed and after that they can collect seed for the next season. Dried seed can be stored in jute or polyethylene bag. For vegetable growing, farmers can buy seed from general farm input stores at 20-80 baht per gram depending on crop types. Also local and Chinese vegetables seed, the farmers bought from shop and receive free from cooperative and related organization.

3) Type of crop

The farmers made a list of vegetables which they would like to grow, based upon group decision, marketing demand and climate including rice, groundnut, banana, cucumber, gourd, bitter gourd, yardlong bean, angle bean, kale, lettuce, coriander, pakchoy, eggplant, Chinese cabbage and okra. Moreover, the groups of farmers had a meeting every 2 months for the decision making on their planting plan that were based on market demand and climatic condition.

4) Planting method

Farmers in this area used to grow one type of crop in large land area. Since they changed to integrated or intercropping, they started with land preparation either by two-wheel tractor or by hand and then broadcasting or direct seeding for vegetables that are easy to manage and the seed cost is cheap such as Chinese vegetable, local vegetable. However, transplanting was also practiced where the crop required soil moisture and seeds are expensive such as kale, broccoli etc. The intercropping was also observed indicating that farmers used land more efficiently. Mixed cropping may mean growing alternate rows of each crop (intercropping), mixing crops within a row, or broadcasting (mixing the crops purely at random). Sometimes, the second crop is planted only after the first one is well established. Mixed cropping has the advantage of lowering the risk to the farmer in case one of the crops fails. Once in a while, the rainfall in the growing season may cause a certain crop to fail completely but there is a very small chance that two crops with different rain requirements will fail at the same time. Another advantage is that insect populations will be smaller in mixed cropping than in pure stand because the quantity of plants of one type together will be less, which makes them less attractive to the insects

5) Soil nutrients management

Farmers in this area have adopted the on-farm production of fermented bio-extracts as a supplement to, or replacement for chemical fertilizers. They used bio-extracts either singly or in combination with other organic amendments in crop production. They applied cow manure after the fields having been ploughed to enhance the soil nutrients as well as improve the soil texture and accelerate decomposition of organic materials thus increasing the soil microorganism's effectiveness. Manure was also applied to promote growth of vegetable crops and was usually done 15-30 days after seed germination.

6) Pest management

Farmers in this area indicated that using crop rotations can lead to better management of pest outbreak, increase in soil fertility, optimal nutrient and water use by crops, and improved quality of soil resources. With natural farming using herbs, organic and biological components; farming can be self-sustaining, lower production cost, improve soil texture and fertility, increase land productivity, protect and enhance the healthful environment and produce food crops safe and healthful to consumers.

7) Weed management

Farmers did this in many different ways such as hand-pull weeds or use a hoe to kill them, slash weeds and the cover crop with a machete or billhook, and use animal or tractor-drawn knife roller.

8) Harvesting

Manual picking was practiced and frequency of picking depended on the variety of vegetable.

Mae Taeng District

1) Land preparation

Before a crop is sown, the land is prepared. This is done to loosen the soil so that the roots can grow and so that rain can penetrate more easily, to turn organic matter (and sometimes manure or organic fertilizer) under into the soil, to control the growth of weeds. In this area, land can be prepared in three ways: by hand (using a spade, hoe, rake, etc.), by animal-drawn implements (a plough, harrow, etc.) and by heavier tractor-drawn implements depending on the size of land and the budget.

2) Seed

Most farmers bought the seeds from outside (the wholesale or retail markets). Some farmers got the vegetable seeds from government support (extension officers, researchers) especially in the areas that the extension officers or researchers visited. Some farmers used the local seed varieties kept from previous season. The seeds were sun-dried, and kept in a cool, dry place for the next season planting. Farmers' management of vegetable seeds for self-reliance was commonly practiced in rice and coriander.

3) Type of crop

A large variety of fruit trees like banana were incorporated in the farm, as were native vegetables and herbal plants, and Chinese kinds of vegetable all year round. Raised in the farm were also swine, chicken, cattle, and fish.

4) Planting method

The farmers in this area practiced crop rotation that is the succession of different crops grown on the same field over the years. A good crop rotation helps preserve or restore soil fertility, because different crops use different nutrients and leave different residues. A rotation may include food and cash crops, grass and fodder crops (crops which are used to feed livestock), or simply leaving the land fallow for a few years (allowing the natural vegetation to grow back). If legume crops (peas and beans) are included in a rotation, they will take nitrogen from the air and fix it in the soil, thus helping replace the nitrogen removed by previous vegetables.

5) Soil nutrients management

The farmers produced fermented bio-extracts themselves and the main ingredients are golden apple snail and climbing wattle. They used organic fertilizers on different crops to improve the soil's physical structure (soft and loose soil), chemical (increase nutrients), and biological (high population of beneficial microorganisms) composition, improve yields and the quality of produce. Cover crops planted prior to the main cash crop can improve soil fertility and provide a valuable source of organic matters.

6) Pest management

The farmers coordinated the planting and harvesting dates to avoid certain pests that would otherwise build up in some crops. Proper rotation of pest-susceptible main crops with non-susceptible varieties and cover crops can keep pest numbers low. Some farmers sprayed strong flow of water on the vegetables in order to get rid of insects. Castor oil smeared yellow color empty tins or plates are kept in the field. Furthermore, farmers in this area adopted such integrated pest management (IPM) methods as the selection of appropriate planting date to avoid pest attack, rotational cropping, use of mosquito net, net, trap, and fruit wrapping.

7) Weed management

In the past farmers controlled weeds by using pesticides which caused the negative impact on the environment, ecological balance, and the farmers themselves. On an organic farm under this research, weeds are controlled using crop rotation, hoeing, mulches which cover the soil and stop weed seeds from germinating, hand-weeding for Chinese vegetable plots or the use of machine, planting crops close together within each bed to prevent space for weeds to emerge, green manures or cover crops to outcompete weeds, soil cultivation carried out at repeated intervals and at the appropriate time, when the soil is moist.

8) Harvesting

Hand picking was practiced and frequency of picking depended on the variety of vegetable. This was done by the farmers themselves in the morning and evening for selling in the market in the next day.

Samoeng District

1) Land preparation

Vegetable plot should be prepared by ploughing soil 20-30 cm deep (the depth of ploughing has direct effect upon vegetable root system), sun drying soil for 7-10 days, making ridge at 1.2-1.5 meter width and at the length depending on the population of planted vegetables. In rainy season, planting was done in single row with the ridge prepared higher for good ventilation, enough sunlight through vegetable plot and good drainage system to prevent flood/logging. These methods permitted the prevention of pest outbreak. Farmers ploughed soil before sowing seed or planting with the primary purposes of turning over the upper layer of the soil, bringing fresh nutrients to the surface, while burying weeds and the remains of previous crops, allowing them to break down. Ploughing also aerates the soil, and allows it to hold moisture better. In modern use, a ploughed field is typically left to dry out, and is then harrowed before planting.

2) Seed

Farmers generally collected seeds from the last harvest season. In the case of Chinese vegetables that they cannot produce or collect the seeds themselves, they

could get some from the Ministry of Agriculture and Cooperatives or simply bought the seed from stores.

3) Type of crop

Farmers grew Chinese kinds of vegetable which are short-season crops such as cabbage, broccoli, cauliflower, Bok Choi cabbage, Chinese celery, and carrot according to the crops' growing seasons. They also intercropped short-season native vegetables such as local tomato, spiny amaranth or pig weed, Indian tree basil, native green cabbage, rattail radish, and yard long beans with Chinese vegetables as well as with such perennial plants as acacia pennata, Gymnema inodorum Decne, chayote, eggplant, Turkey berry or devil's fig, bird chili, and herbal plant like galangal and lemon grass. If there was a pond in their farming area, they would as well raise fish. Animal pen and den were also built to raise chicken, swine, and cattle which could feed on crop residues and other farm wastes. Meanwhile, the animal excretes and faces were utilized as organic fertilizer.

4) Planting method

Mixed cropping of vegetables was common in this area. Diverse varieties of vegetable both native and Chinese kinds were cultivated year round depending on season. Many kinds of fruit tree were also established in large number. Large livestock were often kept in pen or stable while small animals like chicken and duck were allowed to roam freely for food in farm plots and areas nearby. Pond on farm was also common for raising fish.

5) Soil nutrients management

Soil fertility is the key factor for organic crop production in strengthening crop to resist pest outbreak. It can allow cultural practices without the use of pesticides which have impact on crop quality and nutrition. New area usually has high soil fertility which is an advantage for organic crop production. Low soil fertility area should be manipulated for improvement in soil chemical properties including pH and soil nutrients, in biological factor like soil microorganism and in physical properties (soil texture) for good drainage system and good soil aeration for the survival and viability of soil organisms. One of the best ways in organic crop production is the use of organic fertilizer in the forms of green manure and compost. Moreover, green

manures are also used to increase the fertility of the soil in the case of organic farming.

6) Pest management

The farmers practiced cultural control by using existing biological measures such as proper cultivation and crop planting pattern (scheduled planting in specific period, so pests will be minimized as they will have no host after crop harvest.) They learnt the life cycle of specific insect pests. Hand picking is a labor-intensive but effective way to control insects large enough to be seen. Cabbage worms can often be spotted, and many caterpillars are easy to grab. All caterpillars eat plant material, but some eat only a little. Cutworms and slugs can be captured at night, if farmers patrol plants with a flashlight. But by hand picking, one will be forced to look at plants closely and he will soon become familiar with all the insects in his farm, bad ones and good ones.

7) Weed management

In this area, farmers avoided the use of herbicides which, like pesticides, leave harmful residues in the environment. Beneficial plant life such as host plants for useful insects may also be destroyed by herbicides. Farmers controlled weeds by hand weeding. However, at the beginning of transformation process, farmers used herbicides in the heavily weed infested fields, where hand weeding was not effective but the group monitoring systems stimulated farmers to reduce and stop using herbicide and apply hand weeding for organic management.

8) Harvesting

Hand picking was practiced and frequency of picking depended on the variety of vegetable.

From the study on organic farming practices, it is evident that farmers in all the three areas shared many similar features because they all received the training and field visit experience from the same sources. There was slight difference in terms of land preparation and soil management which varied with the land and soil conditions in each locality, and in terms of farmer's decision to cope with emergency and management problems which varied according to each individual's farming experience. Additional background information and cultural practices are presented in Table 4.2.

Table 4.2 Current production practices used by organic vegetable farmers in the studied area

Items	Phrao n= 24		Mae Taeng n=60		Samoeng n=24	
	Frequency	%	Frequency	%	Frequency	%
Water resource						
-irrigation	16	66.67	41	68.33	13	54.17
-natural	6	25.00	7	11.67	3	12.50
-ground water	2	8.33	12	20.00	8	33.33
Soil preparation						
-compost application	12	50.00	27	45.00	10	41.67
-ploughing for weed control	9	37.50	19	31.67	9	37.50
-ploughing and drying soil for at least 7 days	3	12.50	14	23.33	5	20.83
Labor for soil preparation						
-human	15	62.50	22	36.67	8	33.33
-animal	3	12.50	13	21.67	2	8.33
-machine	6	25.00	25	41.66	14	58.34
Soil type						
-loam	7	29.17	35	58.33	13	54.17
-sandy loam	9	37.50	20	33.33	7	29.17
-clay	5	20.83	4	6.67	2	8.33
-sandy	3	12.50	1	1.67	2	8.33
Soil fertility						
-very good	6	25	31	51.67	10	41.67
-good	6	25	24	40	6	25.00
-fairy good	8	33.33	4	6.67	7	29.17
-poor	4	16.67	1	1.66	1	4.16
Weed management						
-hand-pull	16	66.67	41	68.33	9	37.50
-cutting	8	33.33	19	31.67	15	62.50
Pest management						
-predatory insects	-	-	3	5	3	12.50
-yellow trap	10	41.67	11	18.33	3	12.50
-light trap	3	12.50	5	8.33	3	12.50
-plastic or hay covered plot	4	16.67	9	15	4	16.67
-net	4	16.67	25	41.67	10	41.67
-bio-extract	3	12.49	7	11.67	1	4.16

Table 4.2 Current production practices used by organic vegetable farmers in the studied area (Continued)

Items	Phrao n= 24		Mae Taeng n=60		Samoeng n=24	
	Frequency	%	Frequency	%	Frequency	%
Harvest						
-scissors	6	25.00	19	31.67	8	33.33
-picking	18	75.00	41	68.33	16	66.67
Post-harvest						
-refrigerator	-	-	3	5.00	5	20.83
-plastic bag	4	16.67	14	23.33	6	25
-foam packing	7	29.17	11	18.33	5	20.83
-basket	13	54.16	32	53.34	8	33.34
Market channel						
-shopping mall	-	-	6	10.00	4	16.67
-merchant	3	12.50	4	6.67	6	25
-local market	5	20.83	8	13.33	1	4.17
-organic market	16	66.67	42	70.00	13	54.16
How to sell products	13	54.17	18	30.00	10	39.41
-retail	11	45.83	84	70.00	14	60.59
-middleman						

Source: Survey, 2013

4.3 Material cost

According to farmers who are producing organic vegetables, in the early stages of going organic, costs are relatively high. This is because farmers must buy the materials for production such as nets, seeds, bio-extract and it takes a long time to take care of vegetable plots until they have enough experience to cultivate organic vegetables. Then they can reduce their cost by using inputs from on-farm resources and replacing all the chemical substances (Table 4.3). In addition, all kinds of plant residues, such as rice straw and vegetables, are more commonly utilized as materials for compost, along with animal waste from cattle, pigs and chickens. Farmers have started to make investments in their ponds and crops in the dry season and benefit from pond fish as a new source of both protein and income. Diversifying the life-cycle can ultimately minimize financial risks and help preserve biodiversity.

Table 4.3 Cost in vegetable production systems

Farmer groups		Phrao n=24	%	Mae Taeng n=60	%	Samoeng n=24	%
Material cost (baht/rai/year)	Seed	3,500	12.03	4,300	15.93	4,800	15.43
	Organic fertilizer	6,400	21.99	5,000	18.52	4,600	14.79
	Pest control	2,200	7.56	2,000	7.41	2,100	6.75
	Soil preparation	2,500	8.59	1,800	6.67	2,000	6.43
Labor cost (baht/rai/year)	Planting	3,000	10.31	3,500	12.96	4,500	14.47
	Organic fertilizer	6,000	20.62	4,500	16.67	7,000	22.51
	Pest control	3,000	10.31	3,800	14.07	4,000	12.86
	Weed control	1,500	5.15	1,200	4.44	900	2.89
	Harvesting	1,000	3.44	900	3.33	1,200	3.86
Total		**29,100**		**27,000**		**31,100**	

Source: Survey, 2013

4.4 Market arrangement

There are many retail markets for organic vegetable products. Some markets belong to Chiang Mai University, some belong to local government agencies, some are owned by private business. All the markets play important roles in the marketing system in assembling and distributing organic vegetable products such as local market, community market (Jing-Jai market (JJ), The Prince Royal's College School market, etc.). The groups use sticker showing the brand of the group. The price of products depends on customers' demand, market demand and groups' agreement. The survey found that the head of each group buys vegetables from the members, and then

sells the products in a community market a significant distance from the farm. Due to this, they must pay high prices for transportation and gasoline.

Farmers in the three areas generally shared common marketing management methods. They sold part of their vegetable outputs in the local market and sold some part to the group leaders for selling in JJ Market on Saturday market fair. Some farmers would take the ride with the group leaders by sharing the fuel cost to bring their produce and products either vegetable, slaughtered chicken, or local dishes like chili dip, steamed sticky rice, and fried fish for selling in the market themselves.

The fact that the organic agricultural producers had rather secured market outlets such as village fresh food market, nearby market fair, hospital, or even the buyer at farm gate, these farmers seemed to be content with their existing markets and thus did not seek additional marketing channels.

4.5 Benefits from organic vegetable production

This topic discussed some benefits of organic vegetable farming systems observed from the study. The survey reveal that of the benefits of organic vegetable farming system were in many aspects such as enhanced biodiversity, better human health as described below:

Organic agriculture is also advantageous to small farmers because it uses their traditional knowledge of the natural environment and of the unique relationships between various crops or animals and the environment. It is thus somewhat easier for small farmers to understand. At the same time, it avoids chemical inputs, which for small farmers are generally higher priced (because of increased transportation costs in rural areas and higher unit costs brought about by lower volumes), and to which they have not become as dependent as large-scale conventional farmers often have. Furthermore, the health factor of not having to handle harmful chemicals is particularly important to small farmers.

1) Enhanced biodiversity

The level of biodiversity that can be yielded from organic farming provides a natural capital to humans. Species found in most organic farms provide a means for agricultural sustainability by reducing amount of human input (e.g. fertilizers,

pesticides).The study showed that these target areas have more plant diversity such as greater floral diversity, more earthworms, more insects, more butterflies, and increased numbers of some types of birds. This suggests that invertebrate feeders in particular benefit from organic systems in simple landscapes due to increased food resources (invertebrates). In organic farms in Mae Taeng District, fish, shellfish, and crabs are found living in the water channel between vegetable beds. Meanwhile, in Phrao District, many kinds of bird and amphibian were seen in vegetable plots and organic paddy fields including the surrounding wet and dry areas.

2) Better health

The organic models of production have also been associated with positive effects on the health of producers and workers and on the environment. This statement, however, is based on qualitative evidence, as no measurements have been obtained to support it precisely. Most organic producers have argued that their concerns about the potential effects of chemical inputs on health have been an important factor in their shift to organic methods of production. In addition, organic producers have usually used environmentally friendly technologies, sometimes even before certifying their plantations as organic by cultivating their crops under the shade of native trees and using few or no chemical inputs. The few studies identified have found that these systems have helped preserve natural forests and biodiversity, being characterized by a high number of species of trees and birds. Farmers' health was better, not only in physical terms, but also mentally, with less quarrelling and tension, more freedom and better moods. Some also mentioned the health benefits associated with eating vegetables that they had produced, as well as those benefits being passed on to other consumers.

Farmers in the three studied areas gained better health after they had discontinued the use of weedicides and other pesticides because toxin accumulation in human body would be associated with their routine use of and persistent exposure to these agro-chemicals, entitling them to fall victim of illness or be prone to cancer risk. With improved health, organic farmers no longer had to spend money for buying medicines or visiting physicians. Reportedly, a visit to medical clinic or hospital will cost the farmer about 200-300 baht. Farmers could also save food expense by relying

on their own crop outputs instead of buying vegetables from market place although sometime they still had to buy some meat and food ingredients from the market.

Table 4.4 Benefit from organic vegetable production on health

Better health	**Phrao n=25 (%)**	**Mae Taeng n=58 (%)**	**Samoeng n=25 (%)**	**Total n=108 (%)**
Low	3 (12.00)	13 (22.41)	5 (20.00)	21 (19.44)
Medium	5 (20.00)	18 (31.03)	8 (32.00)	31 (28.71)
High	17 (68.00)	27 (46.56)	12 (48.00)	56 (51.85)
Total	**25 (100)**	**58 (100)**	**25 (100)**	**108 (100)**

Source: Survey, 2013

3) Environmental improvement

Organic systems reduce the impact of the farming system on the wider environment and contribute to the conservation of natural habitats which lead to biodiversity. Specific benefits include: increased biodiversity on farms and in the landscape at large; improved physical properties of soil; lower levels of soil erosion; reduced nitrate pollution; restriction of pesticide use; reduced levels of controlled waste; increased energy efficiency; improved animal welfare; and enhanced water efficiency and improvements to water quality. Organic agricultural areas possess tremendous ecological and environmental values particularly in creating an ecological balance consequential to the restoration of soil fertility and the biological control of agricultural pests. Therefore, organic farming must be grounded in ecological system's functioning, relationship, and recycling. Farmers' cultivation, animal raising, and forest product gathering activities should be carried out in compatibility with the natural cycles of various bio-life and with a consideration of the ecological system's balance. Since the ecological system is endogenously unique in a particular locality, the management of organic agriculture in any area has to be designed or decided for suitability in the context of local culture, agro-ecology, and household farm size. Nevertheless, the management wherever still shares a common principle of optimizing the use of resources either renewable like bio-life, soil, and water or non-

renewable like energy and minerals by means of recycle, reuse, and efficient utilization to sustainably save natural and economic resources and protect the environmental quality. Farmers in Phrao where farm lands are generally adjacent to forest area demonstrated their agreeable relationship with the natural system by conserving the forest resources and collecting seasonal forest products like wild mushrooms and bamboo shoots for selling in the market.

4) Income generation

A major advantage of organic agriculture for small farmers is the higher and generally more stable prices that specialized market offers. Among the many benefits brought about by higher incomes are higher standards of living, increased food security and more living expense for household consumptions. Household income increased with the contemporary growth of organic food market particularly in Chiang Mai as evident by the popular Chiang Mai organic home market and JJ Market. Some organic farmers were reached at the farm gate by group leaders or market middle agents who came for procuring the produce for further sale and distribution, and each farmer could make averagely 200 baht per day or 6,000 baht per month. However, the organic vegetable outputs remained inadequate to answer the growing market demand because some farmers could not produce the kinds of vegetable the market wanted while some produced organic vegetables just for home consumption.

5) Declining of production costs

By definition, organic farming does not incur the use of expensive agrichemicals. The greater resistance of their crops to pests and the diseases save farmers significantly from expensive insecticides, fungicides and other pesticides. Fertilizers are either created in situation by green manure via composting and worm farming. Farmers use a low cost microbial solution sprayed onto their crops. For those farmers who used to depend on agro-chemicals for farming, their switch to organic vegetable production helped save their expense for chemical fertilizers and pesticides as they utilized the local raw materials for producing organic fertilizer, neem extract, and liquid bio-fertilizer to replace the purchased inputs.

4.6 Constraints on organic vegetable production

The disadvantages or constraints inherent in small-farmer adoption of organic agriculture were seen to include: the limited amount of truly scientific research on organic technologies, especially under small-scale farming conditions; the often difficult access to needed plant materials, animal breeds and plant-protection inputs; lessened ability to react to unforeseen external factors, such as the sudden arrival of new pests or diseases; the high cost of certification; the difficulty small farmers have in negotiating contracts with buyers; inaccessibility of organic markets to most small farmers; and the bias of most nations' legal structures in favor of conventional agriculture.

One of the potential problems that small farmers may face in producing organically is the limited supply of technologies that are effective in solving technical problems like the control of weeds, pests and diseases and that are appropriate in terms of the particular characteristics of the farmers like their limited access to credit. Thus, it is important to analyze organic technologies as regards their development and the incorporation of organic agriculture into the research agendas of agricultural research agencies. Small farmers often have difficulties introducing new technologies because they do not have access to technical assistance of good quality. Because they have limited or no capacity to pay for technical assistance, they have to rely on public extension services that are often underfunded and provide services of low quality. Thus, it is important to understand how small organic producers in the different case studies were able to learn about new organic technologies and the types of technical assistance they received.

Economic constraints include the high initial cost due to the only using land requirement. Farmers should start with healthy soil by only using land for 3-5 years and natural inputs applied such as the costs for planting materials, soil management, and maintenance of vegetable plots. High labor cost was paid for farm management, crop cares, and harvesting. Organic farming generally incurs higher production cost compared to chemical input dependent alternative due to the former's relatively more complicated cultural practices namely the manual removal of weeds from vegetable growing plots which is a time consuming process. High transportation cost was also

felt by those farmers who shared the ride to bring their produce to market for example from Mae Taeng to Chiang Mai City for selling at JJ Market, sharing 200 baht each for fuel expense per round trip. Since the fuel price kept rising, some farmers instead of selling the produce themselves simply sold their outputs to the group leaders who would do the selling in the city.

Conducting to the need of volume produce especially to market and supermarket, and market with modern trade because the produces will get premium price then marketing cost may be necessarily. Most farmers were able to produce enough for home consumption and market. However, some vegetable cultivators from time to time produced inadequately to meet the demand of buyers due to their rather poor crop production planning. The independent decision making of farmers about crop choice and production extent often caused the group's aggregate output volume either too low or too high relative to the market demand for certain crops. Those market oriented farmers might be able to handle their production plan but their subsistence oriented counterparts in most cases were not able to adjust their production plan to cultivate whatever kinds of vegetable the group wanted to procure for supplying to market in response to the rising demand. Although the organic farmers had formed themselves into a producers' group, their primary interest appeared to be their self-reliance in making production plans. Therefore, they just considered that the producers' group once in establishment would serve as a means for knowledge exchange and a supplementary channel for marketing their outputs.

Bio-physical constraints are irregular rainfall and pest incidence. In hot season, insect pest outbreak was highly prevalent in Phrao and Mae Taeng areas particularly aphids in chili pepper and Chinese kale. Farmers would use strong water hose to dislodge the pests or use glue traps or spray neem extract solution for pest control.

Finally, knowledge constraints are lack of understanding of problems on farm such as propagation and land management. Some farmers had problem about plant propagation as they did not know the origin of the stock plants they obtained from other people and hence were not sure about the actual crop characteristics or whether the plants were of GMO type various constraints on organic vegetable production in Chiang Mai are summarized in diagram 10.

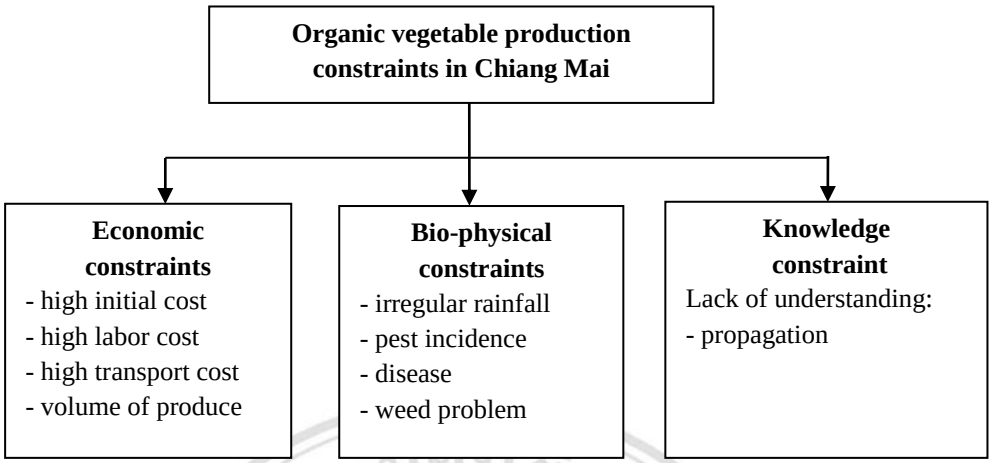

Figure 11 Organic vegetable production constraints in Chiang Mai.

4.7 Socio-economic background of interviewed farmers

Based on the survey's result in 2013 of 108 samples from three districts (Phrao, Mae Taeng and Samoeng), there are four systems of organic farming practice in the studied areas having different lengths of time from the start: 1) 10 years for integrated organic farming (IOF), 2) 10 years for vegetable organic farming (VOF), 3) 5 years for organic farming (FOF), and 4) 1-2 years for organic farming (LOF). Most farmers, 50.93% are male and 49.07% are female. The number of male farmers and female farmers are quite comparable because in general both household head and other household members will join the Organic Agricultural Cooperative. Regarding the age of interviewed farmers, among the three areas (Table 4.5), all of the interviewed farmers were household heads, and they were the main decision makers in their households. 30.69% of these farmers were in the age bracket of 41 to 50, 51 to 60 years old 29.63% were between and 23.15% were more than 60 years old.

About 55.56% of the respondents had no formal education. This could reflect the low levels of literacy of people in the area. Approximately 13.89% of the farmers had high school education. Thus most of them were illiterate. Most farmers 73.15% were married, 14.81% were single and 12.04% are divorced. Agriculture was the main occupation of the majority of farmers (87.96%) and trading was the main profession of the remaining 12.04% who do farming as well as selling their organic vegetables. Based on the survey on family members of farmers, it was found that most sampled

farmers, 42.59% in the three areas had 5-6 members. Only 9.26% of farmers had more than six members in their household. However, despite the large family size, most households had low family labor availability, and this had become threat for intensive farming systems, which had to depend highly on hired labor, especially for those households having land more than one rai. As a consequence, their cash cost of production is higher compared to those households having high family labor availability.

Farm sizes were below 1-2 rai among 41.67% of the respondents. This may be attributed to the fact that most of the farmers were relatively old, who faced financial constraints and had inadequate inputs. Furthermore, the large amount of labor required for operating a large farm could also serve as a constraint. The tenure system of land ownership, fragmentation of farmland and human activities such as the building of roads and industries may force people to have small farm size. About 2.78% of the respondents cultivated more than 7-8 rai. These may be farmers that had access to farmland because they were indigenous to the area or they were leaders of families. Some of them could secure loans and credit facilities, with which they could maintain large farm sizes. Apart from this, they would have cash to buy a large farm. It was also possible that these were young people who could actively increase their farm size. Farm labor was one of the limited farm resources. At present, labor utilization is a very important problem for farm development since skilled labors in rural areas have migrated to the industrial areas. However, small farm machinery was available, as was mechanization technology for use for replacement of farm family labor such as two wheels tractor etc.

Most farmers (43.52%) had off-farm income less than10,000 baht, followed by 37.04% in 10,001-20,000 baht range and 13.89% in 20,001-30,000 baht range. Farmers' farm income especially from organic vegetable farming and animal raising among 33.33% of all household under study was 60,001-80,000 baht, 40,001-60,000 baht among 30.56% of the total and 20,001-40,000 baht among the remaining 20.37%.

Most farmers, 75.92% incurred debt. However, the remaining 24.08% were debt-free as they had enough financial capacity, from selling their previous season crops and save some income, for investing in organic farming without the need for borrowing from any lending sources.

Most farmers (52.78%) borrowed money from their cooperative, and they made loan repayment 200-500 baht per week depending on their income. Some farmers also borrowed money from the Bank for Agriculture and Agricultural Cooperative (BAAC) which provides farmers short term, intermediate term, and long-term loans. Moreover, commercial banks were also formal credit source for farmers. In case farmers for any reasons are forced to seek loan from money lenders, they had to pay interest at the rates higher than those of BAAC or commercial banks. However, the farmers could both save money and get loans from credit unions or village revolving funds if they were members of these community financial organizations.

Most organic farmers in Phrao (62.5%) cultivate rice and vegetables. Most organic farmers in Mae Taeng (63.33%) practiced integrated farming. And most organic farmers in Samoeang also practice integrated farming (44.44%) the systems of organic farming are quite different from place to place due to the local climate and landscape.

In general, kinds of livestock that farmers were rearing in the studied areas were pig, cow, chicken and buffalo. The reason that farmers integrated livestock into their organic vegetable farming was that not only livestock can generate more income, and be the source of cash income in the emergency situation, but it also helps increase the fertility of land by returning its dung and urine to soils, and reduce cost for weed control by its grazing activity. In Phrao District, farmers sold slaughtered chicken in the local market.

The most popular training activity was bio-fertilizer production which was attended by 22.22% of all farmers, followed by organic vegetable farming 21.30%, and bio extract and green manure production and application 17.59%. In each training program, there were generally a number of outsiders such as NGO worker and resource persons from Chiang Mai Organic Farming Cooperative, and Chiang Mai University serving as trainers. Most training activities involved the concept of organic agriculture and bio fertilizer production which can contribute to the ecological

and environmental improvement and hence the sustainable agricultural systems. Furthermore, trainings on processing organic foods were also arranged for processing of various flavored banana chips, hot sand roasted peanuts, herb and nut mix, crystallized nuts, and brown rice milk.

Most farmers (23.15%) gained organic agricultural production knowledge from NGO, 12.96% from neighbors and relatives, 11.11% from documents. It is obvious that most farmers obtained the knowledge about organic agriculture from the NGOs which organized training platforms to introduce the concepts of organic farming to farmers in various village communities. From the training, farmers gained better knowledge and understanding about organic agriculture particularly the emphases on minimization of dependence on external inputs, ability to reduce household debts, and the holistic production patterns incorporating various elements of tree, plant and animal in the farming resources.

Table 4.5 Socio-economic background

Socio-economic background	Phrao n=24 (%)	Mae Taeng n=60 (%)	Samoeng n=24 (%)	Total n=108 (%)
Length of organic farming				
Integrated organic farming (IOF)	6 (25.00)	20 (33.30)	5 (20.80)	31 (28.70)
Vegetable organic farming (VOF)	9 (37.50)	26 (43.30)	15 (62.50)	50 (46.30)
5 years for organic farming (FOF)	6 (25.00)	14 (23.30)	4 (16.70)	24 (22.22)
1-2 years for organic farming (LOF)	3 (12.50)	-	-	3 (2.80)
Gender				
Male	15 (62.50)	29 (48.30)	11 (45.80)	55 (50.93)
Female	9 (37.50)	31 (51.70)	13 (54.20)	53 (49.07)
Age (years)				
20-30	1 (4.20)	1 (1.70)	-	2 (1.85)
31-40	6 (25.00)	6 (10.00)	4 (16.70)	16 (14.82)
41-50	7 (29.20)	18 (30.00)	8 (33.30)	33 (30.69)
51-60	6 (25.00)	19 (31.70)	7 (29.20)	32 (29.63)
More than 60	4 (16.70)	16 (26.70)	5 (20.80)	25 (23.15)
Educational level				
Illiterate	17 (70.80)	29 (48.30)	14 (58.30)	60 (55.56)
Primary school education	5 (20.80)	21 (35.00)	7 (29.20)	33 (30.56)
High school education	2 (8.30)	10 (16.70)	3 (12.50)	15 (13.89)

Table 4.5 Socio-economic background (continued)

Socio-economic background	Phrao n=24 (%)	Mae Taeng n=60 (%)	Samoeng n=24 (%)	Total n=108 (%)
Status				
Single	4 (16.70)	9 (15.00)	3 (12.50)	16 (14.81)
Married	15 (62.50)	43 (71.70)	21 (87.50)	79 (73.15)
Divorced	5 (20.80)	8 (13.30)	-	13 (12.04)
Agriculture	21 (87.50)	51 (85.00)	23 (95.80)	95 (87.96)
Trading	3 (12.50)	9 (15.00)	1 (4.20)	13 (12.04)
Number of HH member				
1-2	4 (16.70)	9 (15.00)	4 (16.70)	17 (15.74)
3-4	10 (41.70)	15 (25.00)	10 (41.70)	35 (32.41)
5-6	10 (41.70)	26 (43.30)	10 (41.70)	46 (42.59)
More than 6	-	10 (16.70)	-	10 (9.26)
Land holding (rai)				
1-2	8 (33.30)	22 (36.70)	15 (62.50)	45 (41.67)
3-4	12 (50.00)	24 (40.00)	8 (33.30)	44 (40.74)
5-6	4 (16.70)	11 (18.30)	1 (4.20)	16 (14.81)
7-8	-	3 (5.00)	-	3 (2.78)
More than 8	-	-	-	-
Labor				
1-2	16 (66.70)	43 (71.70)	18 (75.00)	77 (71.29)
3-4	8 (33.30)	12 (20.00)	6 (25.00)	26 (24.07)
5-6	-	5 (8.30)	-	5 (4.63)
More than 6	-	-	-	-
Off-farm income (Baht/year)				
Less than10,000	9 (37.50)	31 (51.70)	7 (29.20)	47 (43.52)
10,001-20,000	8 (33.30)	18 (30.00)	14 (58.30)	40 (37.04)
20,001-30,000	4 (16.70)	8 (13.30)	3 (12.50)	15 (13.89)
30,001-40,000	3 (12.50)	3 (5.00)	-	6 (5.56)
More than 40,000	-	-	-	-
Farm income (Baht/year)				
Less than20,000	-	4 (6.70)	-	4 (3.70)
20,001-40,000	4 (16.70)	13 (21.70)	5 (20.80)	22 (20.37)
40,001-60,000	7 (29.20)	11 (18.30)	15 (62.50)	33 (30.56)
60,001-80,000	10 (41.70)	22 (36.70)	4 (16.70)	36 (33.33)
More than 80,000	3 (12.50)	10 (16.70)	-	13 (12.04)
Farmers' indebtedness (Baht/year)				
In-debt	12 (50.00)	50(83.30)	20(83.30)	82(75.92)
Debt-free	12 (50.00)	10(16.70)	4(16.70)	26(24.08)
Source of loan				
Neighbor	10 (41.70)	10 (16.70)	3 (12.50)	23 (21.30)
Local merchant	3 (12.50)	1 (1.70)	-	4 (3.70)
BAAC	2 (8.30)	15 (25.00)	7 (29.20)	24 (22.22)
Cooperative	9 (37.50)	34 (56.70)	14 (58.30)	57 (52.78)
Village fund	-	-	-	-

Table 4.5 Socio-economic background (continued)

Socio-economic background	Phrao n=24 (%)	Mae Taeng n=60 (%)	Samoeng n=24 (%)	Total n=108 (%)
Farming practice				
Integrated	4 (16.67)	38 (63.33)	6 (25.00)	48 (44.44)
Rice/vegetable	15 (62.50)	5 (8.33)	2 (8.33)	22 (20.37)
Vegetable	5 (20.83)	17 (28.34)	16 (66.67)	38 (35.18)
Livestock				
Pigs	7 (29.20)	17 (25.00)	11 (45.80)	35 (32.41)
Cows	4 (16.70)	7 (11.70)	8 (33.30)	19 (17.59)
Chickens	10 (41.70)	30 (50.00)	5 (20.80)	45 (41.67)
Buffaloes	3 (12.50)	8 (13.30)	-	11 (10.18)
Others	-	-	-	-
Participation in organic training				
None	-	-	-	-
Organic rice production	1 (4.00)	3 (5.20)	1 (4.00)	5 (4.63)
Organic Integrated farming	4 (16.00)	11 (19.00)	3 (12.00)	18 (16.67)
Bio-fertilizer	5 (20.00)	11 (19.00)	8 (32.00)	24 (22.22)
Organic vegetable farming	7 (28.00)	13 (22.40)	3 (12.00)	23 (21.30)
Bio-extract	5 (20.00)	12 (20.70)	2 (8.00)	19 (17.59)
Green manure	2 (12.00)	10 (13.80)	7 (32.00)	19 (17.59)
Source of knowledge received				
Department of Agriculture	5 (20.00)	2 (3.40)	2 (8.00)	9 (8.33)
Center of new theory farming	2 (8.00)	3 (5.20)	4 (16.00)	9 (8.33)
Agricultural Extension Officer	3 (12.00)	3 (5.20)	-	6 (5.55)
NGO	4 (16.00)	13 (22.40)	8 (32.00)	25 (23.15)
Volunteer soil technicians	-	10 (17.20)	1 (4.00)	11 (10.18)
Neighbors and relatives	6 (24.00)	2 (3.40)	6 (24.00)	14 (12.96)
Documents/books	-	11 (19.00)	1 (4.00)	12 (11.11)
Radio/TV	5 (20.00)	3 (5.20)	3 (12.00)	11 (10.18)
Organic farming day campaign	-	11 (19.00)	-	11 (10.18)

Source: Survey, 2013

4.8 Perception of organic vegetable production

This topic is presenting the results and discussions in response to the second objective of this study, regarding farmers' perception in organic vegetable farming in Chiang Mai. The detailed information and results gained from each practice process are used to assess perception of organic vegetable production systems and are furthermore presented and discussed in this part. Afterwards, the overall organic practice scores are presented in percentage. There are eight main practices related to organic vegetable production being discussed.

Most farmers used all their perception and ability to revive the severely damaged soil from previous agro-chemical application to the condition appropriate for cultivation again. Beginning with their attending the related trainings organized by the NGOs and Chiang Mai Organic Agriculture Cooperative, Ltd, they applied what they had learned on their farm fields such as the amelioration of soil by organic matters, the discontinued use of all kinds of agro-chemical, and experimenting on producing various formula of green manure. Their organic practices helped save enormously their chemical input cost. When facing the agricultural pest problem, they adhered to the principle of nature against nature. For example, when golden apple snails broke out to destroy rice plants, farmers would spray the fermented used-tea leaves liquid onto the pests. The dead golden apple snails can also be processed into excellent natural fertilizer in either solid or liquid form for soil amelioration.

According to organic vegetable production practice from the North Organic Standard Association (NOSA) it was found that farmers had medium level on the history of cultivation area (time to stop using the chemical and conditions on approvals). As the farmers had received the training from the North Organic Standard Association (NOSA) as well as had gone through the latter's standard inspection procedure, they appeared to have a fair knowledge about the aftermath of their historical land uses and hence became able to make their farm fields ready for the cultivation of organic crops and ready for the application for organic standard approval.

Farmers appeared to have high level of knowledge on conditions of overall farming operation such as deforestation, soil conservation and prevention of soil erosion, distance from chemical plot, how to prevent chemical from air, insect repellent crop planting, biodiversity, collection, selection and improve native plants and genetically modified organism (GMO). Because farmers had to prepare the field conditions to become appropriate for organic crop cultivation, they took the field inspection to make sure that everything was well in place for making request for organic standard approval from the North Organic Standard Association.

Farmers revealed high knowledge level on soil (soil improvement, not destroy soil and ecological systems and soil fertility). Farmers had applied their farm-produced animal manure, compost, and green manure in the vegetable plots to

enhance soil fertility and the result was the excellent and healthy growth of their vegetable crops.

High level of knowledge was exhibited on fertilizer (organic matter) since the farmers themselves could produce organic fertilizer for their own farm use. Some farmers bought from the group leaders the organic fertilizer at 90 baht per 20 kg. sack or at the average cost of 4.50 baht per kilogram.

High level of knowledge was also found about seed and propagation (seed and propagation); water management (how to protect chemicals from water); harvesting and marketing (harvesting, storage and curing, transportation, clean and prolong life and marketing).

In each target area, farmers had some perception on organic vegetable farming at the same level based on the North Organic Standard Association (NOSA) criteria, because they were trained by Chiang Mai Organic Agriculture Cooperative. From over 1 0 years' experience in organic farming, most farmers especially those in Mae Taeng District had gone through a series of the related cultural trials and practices and thus they ended up with the finding that "organic agriculture" was the path to achieve the realistic and sustainable increase in farm productivity, the reduction in production cost, the liberalization of themselves from perpetual debts, the improvement in family income, the vigorous physical as well as mental health, the food safety protection for consumers, and the avoidance of their harmful actions on the environment.

The analysis revealed that farmers' perception on organic agriculture standard was most prevalent at the moderate level followed by that at the high level. This was because farmers must have been certified for organic agriculture standard before joining the Chiang Mai Organic Agriculture Cooperative with the purpose to win the recognition from food producers, consumers, and various organizations at the local, national, and international levels.

1) Cultivated field background

1.1) Duration of chemical disuse

This medium and high level of knowledge was due to simplicity of some of technology and government support to the organic farming till date.

Farmers have medium perception level about an area which chemicals have never been used organic agriculture for at least 6 months. This case was most predominant in Mae Taeng District.

Farmers have medium perception level the annual crop field; the duration of chemical disuse must be longer than 12 months. This case was most predominant in Mae Taeng District.

Farmers have medium perception level about the perennial field; the duration of chemical disuse must be longer than 18 months. This case was most predominant in Mae Taeng District.

Farmers have high perception level about farmer must perform organic agriculture for 36 months in order to be approved as an organic agriculture (Since applying for approval). It is a standard for the transition period. This case was most predominant in Mae Taeng District.

1.2) Regulations after approval acquired

Farmers have medium perception level about the requirement that the approved farmers must convert all cultivated areas to organic agriculture within 4 years. A written plan of conversion is required. This case was most predominant in Mae Taeng District.

2) Overall condition of the fields

The study showed that the perception percentage about the overall condition of the fields was high. The respondents (53.12%) were found to have high level of knowledge followed by medium level (39.35%). However, only 8.14% of the respondents belonged to low level of perception category regarding deforestation, soil conservation and soil erosion prevention, distance from an agrochemical field, how to prevent chemical contaminants via wind, insect attractant and repellent plants, biodiversity, collection, selection, and improvement of native plants, genetically modified organisms in organic farming. These medium and high levels of knowledge

were due to their routine of farmers' practice so they can percept and understand these points.

2.1) Deforestation

Farmers have medium perception level about not to encroach on forest area. If the cultivated area is in the forest area, document of right is required (e.g. a document which is approved by the government or local administration). This case was most predominant in Mae Taeng District. They understood the rule and had the right for their land.

2.2) Soil conservation and soil erosion prevention

Farmers have high perception level about that ground cover plants are needed to help prevent soil erosion in the steep slope area. This case was most predominant in Mae Taeng District. Because the farmers grown vetiver grass that had strong fibrous root system which rapidly penetrates deep into soil more vertically than horizontally, and develops into a tightly knitted net. It held the soil together and serves as an underground wall which not only retards water flow but also allows it to seep into the soil. So it advantaged to control erosion, retain soil moisture, and improve soil productivity.

2.3) Distance from an agrochemical field

Farmers have high perception level about the need that vegetable garden and fruit orchard must be located at least 1-8 meters away from an agrochemical field. This case was most predominant in Phrao District. Because the farmers were always check and strict on this point for their organic vegetable production.

Farmers have high perception level about rice field having to be located at least 1-8 meters away from an agrochemical field. This case was most predominant in Phrao District. Because the farmers were always check and strict on this point for their organic vegetable production.

2.4) How to prevent chemical contaminants via wind

Farmers have high perception level about that vegetable garden and fruit orchard must have plants as a windbreaker or barrier at least 1-8 meters wide. This case was most predominant in Samoeng District. Because the farmers were always check and strict on this point for their organic vegetable production.

Farmers have medium perception level about the need for rice field to have plants as barrier at least 1-8 meters wide. This case was most predominant in Samoeng District. Because the farmers were always check and strict on this point for their organic vegetable production.

2.5) Insect attractant and repellent plants

Farmers have medium perception level about plant insect attractant and repellent plants spreading throughout 1% of the field. This case was most predominant in Phrao District. The farmers grown marigold for control insect in their plot.

2.6) Biodiversity

Farmers have high perception level about there must be at least 10 types of plants and living organisms that are useful in the area that they are applying for approval. This case was most predominant in Samoeng District. This area had a lot of varieties of animal such as birds, frogs, fishes, butterflies, beetles, crabs etc.

2.7) Collection, selection, and improvement of native plants

Farmers have medium perception level about collecting, selecting, and improving native plants continuously. This case was most predominant in Mae Taeng District. Because the farmers were always grow the native plants for consumption and sell in the market such as Basella alba Linn.

2.8) Genetically Modified Organisms

Farmers have high perception level about prohibition to plant, raise, or use genetically modified organisms in the field. This case was most predominant in Phrao district. Farmers gained seed from their production and NGO so they didn't have GMO seed for their production.

3) Soil

The study showed that the perception percentage about soil was high. The majority of the respondents (83.80%) were found to have high level of perception followed by medium level (12.19%). However, only 4.01% of the respondents belonged to low level of perception regarding soil improvement, soil conservation and environment and soil fertility in organic farming. These results implied that in order to maintain the levels of uptake and utilization of soil fertility technologies in the study

areas, the farmers should be manage their farm in the correct way and prove follow the present circumstance.

3.1) Soil improvement

Farmers have high perception level about the use of only organic fertilizers for plantation.

Farmers have high perception level about raising animals to use as an organic source with the appropriate number in balance with the farming area.

Farmers have high perception level about recording purchase confirmation of organic matter supplement on the farm account. This case was most predominant in Mae Taeng District. Farmers' group had farm account for record their expenditure and income.

Farmers have high perception level about always fermentation to organic matter before using. This case was most predominant in Phrao District. Because the farmers produced compost by themselves and also sell to other farmers.

Farmers have high perception level about planting crop for soil fertility. This case was most predominant in Mae Taeng District. Farmers grow legumes to add nitrogen for soil improvement and nitrogen fixation. Legumes are crops like peas and beans.

3.2) Soil conservation

Farmers have high perception level about not to use chemical fertilizers. This case was most predominant in Mae Taeng District. The farmers do not use chemical fertilizer in their organic production and use compost or manure instead.

Farmers have high perception level about not to burn dead plants/ organic matter in the farm. This case was most predominant in Phrao District. They plough plants/ organic matter into soil because good levels of organic matter can help the structure and nutrient levels of the soil.

Farmers have high perception level about not to use genetically engineered microbes. This case was most predominant in Mae Taeng District. They use nature way to make bio-extract and fertilizer.

3.3) Environment and soil fertility

Farmers have high perception level about there are earthworms or living organisms in the soil. This case was most predominant in Samoeang district. They

find a lot of earthworms in the soil. Greater levels of organic matter will increase earthworm numbers. Earthworms help the soil by churning up the soil organic matter and helping the soil's physical properties. They form channels that help water infiltration, and promote soil aggregation and aeration. Earthworms turn over topsoil, helping bring up deeper soil to the surface, and burying organic matter.

Farmers have high perception level about organic matter can be found in the soil at least 2%.This case was most predominant in Mae Taeng District. Because farmers always applied compost improves the soil structure and also adds nutrients. Compost helps the soil retain moisture and can also warm the soil, as the dark colour absorbs heat.

Farmers have high perception level about soil being friable. This case was most predominant in Mae Taeng District. Because there were various practices that can be carried out to improve the organic matter in the soil including adding compost, green manuring, crop rotation, returning crop residues and applying animal manures.

It is very much linked to the previous point but it influences not only the availability of nutrients but also the overall capacity of the soil to host the plants and, as a consequence, the resilience to stress (too much or too little water, low or high temperature, etc). The solution stays in the accurate planning (of the rotation, of the organic matter use, of the crop residues use, of the soil labors, of irrigation, etc.) and requires time (this is why new organic farmers usually have poorer soils). Several experimental long term rotations in organic farming confirm the need of 5-8 years for the establishment for a proper soil fertility that grants nutrition and resilience to crops. Many organic farmers are still in the building phase or have difficulties coping with maintaining the balance they have reached due to lack of organic matters, market pressure that clashes with rotation, lack of good equipment and skills. The quality of the soil is a key point in the organic management. Poor soil conditions and inadequate investment for its improvement seriously affect the farm performance over the years.

4) Fertilizer management

The study showed that the perception percentage about fertilizer was high. Most respondents (82.51%) were found to have high level of knowledge followed by medium level (11.63%). However, only 5.86% of the respondents belonged to the low

level of knowledge category regarding organic matters in organic farming. The knowledge level of the farmers was low. This could have influence on the acceptance and use of fertilizer technologies among the farmers. If farmers do not adopt a new technology, it is because they do not understand well the technology, it is not compatible with existing practice or because they have perceived the technology to be too complicated or too risky and not because they are ignorant. In the other hand farmers have high perception on fertilizer management means that farmer can perceive how to manage and produce fertilizer from local factors and apply to their farms.

4.1) Organic matters

Farmers have high perception level about organic matters by always using manure or other methods to improve soil fertility. Moreover, the high level of perception was also found in farmers in term of awareness and use of manure or compost from livestock. This case was most predominant in Mae Taeng District.

Farmers have high perception level about not to use manure from chemically tainted livestock. This case was most predominant in Mae Taeng District. Because the farmers used manure from their farm or buy from their group member only.

Farmers have high perception level about document usage information including time of usage and source of manure. This case was most predominant in Mae Taeng District. Farmers had record of manure sources because they had to sell and bought it for group member.

Farmers have medium perception level about not to use organic fertilizer as a precursor or a composition. This case was most predominant in Phrao District. Farmers applied a combination of raw materials high in organic matter, such as manure, along with specific organic fertilizers to target crop needs.

Farmers have high perception level about not to use heavy metals-contaminated organic fertilizer. This case was most predominant in Phrao District. They used only organic matter from their farm to apply in their plots.

Farmers have high perception level about not to use waste from urban area or municipality. This case was most predominant in Samoeng District. Because of organic fertilizers could be made from plant, animal or mineral sources.

Farmers have high perception level about not to use excrement. This case was most predominant in Mae Taeng District. It did not allow using in fertilizer production.

Farmers have high perception level about not to blend slick or inked paper in organic fertilizer. This case was most predominant in Phrao District. It did not allow using in fertilizer production.

Farmers have high perception level about not to use waste from industrial factory. This case was most predominant in Samoeang District. They used waste from their farm without any processing. Good examples of these were green manures, animal manures, and wood ashes. The advantage to this form of fertilization was that not only are main nutrients mentioned above added to the soil, but organic matter and humus, as well.

5) Weed and pest

The study showed that the perception percentage about weed and pest was high. Most respondents (88.10%) were found to have high level of perception followed by medium level (9.13%). However, only 2.78% of the respondents belonged to the group of low level of perception regarding weed, plant diseases and pest in organic farming. Farmers in the study areas have a high perception of weed and pest towards organic farming. This includes managing insects, plant pathogens and weeds that farmers practice based on their experience and training.

5.1) Weed management

Farmers have high perception level about not to cover soil with biodegradable plastic. This case was most predominant in Mae Taeng District. The farmers always used crop rotation for weed management.

Farmers have high perception level about not to use chemical weed control or herbicide. This case was most predominant in Phrao District. The farmers used hand picking or crop rotation for weed control.

5.2) Plant diseases and pest management

Farmers have high perception level about restore agricultural environment by planting attractant and repellent plants and crop rotation. This case was most

predominant in Mae Taeng District. The farmers grown lemon grass and Thai basil protect plant diseases and pest management.

Farmers have high perception level about not to use herbal extracts and prohibited substances according to transitory provision. This case was most predominant in Samoeng District. Because the farmers had to follow the rule of the North Organic Standard Association (NOSA) so they used climbing wattle extract for pest management.

Farmers have high perception level about there should be a biodiversity all over the area. This case was most predominant in Phrao District. This area had a lot of plants and also animals such as frogs, fishes and native plants.

Farmers have high perception level about not to use detergents or synthetic chemical sticking agent or synthetic chemical hormones. This case was most predominant in Mae Taeng District. They used natural inputs such as bio extract spray through the plots.

Farmers have high perception level about not to use machines or equipment that was used in chemical applied garden. This case was most predominant in Samoeng District. They had to protect chemical residues on vegetable production.

6) Seed and propagation

The study revealed that the perception percentage about seed and propagation was high. The respondents (93.29%) were found to have high level of perception followed by medium level (3.70%). However, only 3.01% of the respondents belonged to low level of perception group regarding seed, propagation in organic farming. The perception of seed and propagation are high level because seed is the basic input in agriculture and the most important catalyst for other inputs to be cost effective good quality seed plays a pivotal role in vegetable production. It is very important not only to higher yield but also to get high monetary returns so farmers are quite high percept and concentrate on this part. Most of the farmers were aware to quality seed because, quality seed was costly and it gives high return.

6.1) Seed

Farmers have high perception level about not to use chemical to preserved seeds. This case was most predominant in Mae Taeng district. They stored the seed in plastic in fridge.

6.2) Propagation

Farmers have high perception level about not to use chemical hormones in seed dressing or propagation. This case was most predominant in Mae Taeng District. The choice of high quality organic seed and plant propagation material of suitable varieties is an important key to successful organic farming, allowing for improved yield and product quality, for crop resilience, considerate use of non-renewable resources and for increased genetic and species diversity. So the farmers always use quality organic seed for their production.

Farmers have medium perception level about using only perennial plant branches or reproduction parts of organic garden. Branches from chemically treated garden can be used if the garden has stopped using chemical for at least 12 months. This case was most predominant in Phrao District. Farmers used perennial plant branches from their farm.

Farmers have high perception level about not to use seeds, branches, perennial plant of genetically modified crops. This case was most predominant in Samoeng District. They used seeds, branches and perennial plant from their farm.

7) Water management

The study revealed that the perception percentage about water management was high. Most of the respondents (81.94%) were found to have high level of perception followed by medium level (11.11%). However, only 0.07% of the respondents belonged to low level of perception group regarding preventing chemical contaminants via water in organic farming. Farmers have high perception level about water management because they have explicit knowledge that was shared with the farmers consisted of a technical description of the water management. Also, the much attention was use to safe water, the difference in the nature of the damage between water depletion and humid soil and the long term effects of water depletion.

7.1) Prevention of chemical contaminants in water

Farmers have high perception level about that water clarifier is required if a shared water supply is used with chemical applied garden. This case was most predominant in Mae Taeng District. Farmers used water from rain fed and irrigation.

Farmers have high perception level about that rice field requires water clarifier or the use of buffer garden as a water clarifier. This case was most predominant in Mae Taeng District. The farmers built water clarifier for using in their farm.

Farmers have high perception level about that waste water treatment system is required. This case was most predominant in Phrao District. Farmers had process to clean water before apply to plots.

Farmers have medium perception level about not to use sewage treatment residues. This case was most predominant in Samoeng District. Farmers did not use rotten water in farm.

8) Harvesting and marketing

The study revealed that the perception percentage about water management was high. The respondents (97.92%) were found to have high level of perception followed by medium level (2.08%). However, no respondents belonged to low level of perception regarding harvesting, storage and curing, transportation, cleaning and life extension and marketing in organic farming. They understood well about organic farming by way of intensive awareness approaches.

8.1) Harvesting

Farmers have high perception level about not to use harvest equipment that was used in non-organic garden. In case of necessity, decontamination is needed. This case was most predominant in Mae Taeng District. Farmers used harvest equipment especially in their organic farm.

Farmers have high perception level about keeping harvested products, containers, and storage clean. This case was most predominant in Phrao District. They always cleaned all products and equipment after harvesting.

8.2) Storage and curing

Farmers have high perception level about not to use shared storage with harvested chemically tainted products. This case was most predominant in Samoeng

District. They collected all products before sell in refrigerator that depend on the amount and kind of products.

Farmers have high perception level about do not use curing accelerators. This case was most predominant in Mae Taeng District. They always left their product in natural way and harvest when they set.

8.3) Transportation

Farmers have high perception level about not to share equipment and truck with chemically tainted products. In case of necessity, they must prevent contamination. This case was most predominant in Mae Taeng District. They transported their products with organic member's products and shared gas together when went to sell in the market.

8.4) Post harvesting

Farmers have high perception level about not to use chemicals to extend shelf-life or clean produce. This case was most predominant in Phrao District. They cleaned products with water and put in the package.

8.5) Marketing

Farmers have high perception level about labeling standard mark on the products prominently. This case was most predominant in Mae Taeng District. They had their own stickers and valuable price from group agreement.

Farmers have high perception level about place organic products separate from chemical products. This case was most predominant in Samoeang District. They sold their products in the organic market only such as JJ market.

This would call for intensive efforts to impart perception, to farmers about the advantages of organic vegetable farming. Hence, it should be noted that agricultural scientists and extension officers have propagated organic farming with the intention of protecting the soil health and environment while totally ignoring the health benefits of organic products and the effect of pesticides on human health. Those farmers who had high perception level explained that they had experience on organic vegetable production such as using legume crop and green manure for nutrient improvement as well as crop rotation and applied compost and bio extract.

Several factors may hold certain organic farmers back from reaching their full potential. The relevance of these factors may change depending on the farming

system, on the area, on the farmer's skills etc. Organic vegetable farming works as a complex system managed by the farmer, who has fewer “emergency” tools to adjust production. The organic farmer needs a higher perception level to be able to expect the evolution of the farm and of specific crops, and consequently plan the farm management as a whole. The need for perception exchange among practitioners cannot be easily satisfied due to the still limited number of organic farms and their being spread out widely on a national scale, and with extremely limited perception networks acting.

The farmers’ perception reflected the local and indigenous knowledge of organic farmers on organic vegetable production systems. The criteria for assessing and understanding farmer perception were based on the North Organic Standard Association (NOSA) criteria which are commonly used criteria to extract or analyze farmers’ perception on vegetable farming systems. Additional eight criteria include cultivated field background, overall condition of the fields, soil, fertilizer, weed and pest, seed and propagation, water management and harvesting and marketing. This is the view of farmers about organic farming, and it was assessed by asking the respondents in their local language to indicate their opinion on statements. Their responses were recorded on three point rating scale method of low, medium and high levels namely 3, 2, and 1, respectively. The highest, lowest, and mean scores were obtained. The mean score was used in determining the level of perception of organic farming among the respondents.

Table 4.6 Perception of organic vegetable production

Detail of practices	Level of perception (%)				
	High	Medium	Low	Mean	Level
1.Cultivated field background					
1.1 Duration of chemical disuse					
- An area where chemicals have never been used in order to perform organic agriculture for at least 6 months.	34 (31.48)	61 (56.48)	13 (12.04)	2.19	Medium
- In the annual crop field, the duration of chemical disuse must be longer than 12 months.	27 (25.00)	73 (67.59)	8 (7.41)	2.18	Medium
- In the perennial field, the duration of chemical disuse must be longer than 18 months.	31 (28.70)	56 (51.85)	21 (19.44)	2.09	Medium
- A farmer must perform organic agriculture for 36 months in order to be approved as an organic agriculture (Since the time applying for approval). It is a standard for the transition period.	58 (53.70)	35 (32.41)	15 (13.89)	2.40	High
1.2 Regulations after approval acquired					
- The approved farmers must convert all cultivated areas to organic agriculture within 4 years. A written plan of conversion is required.	46 (42.59)	39 (36.11)	23 (21.30)	2.21	Medium
Total	-	-	-	2.21	Medium
2. Overall condition of the fields					
2.1 Deforestation					
- Do not encroach on forest area. If the cultivated area is in the forest area, document of right is required (e.g. a document which is approved by the government or local administration organization).	43 (39.81)	38 (35.19)	27 (25.00)	2.15	Medium
2.2 Soil conservation and soil erosion prevention					
- Ground cover plants are needed to help prevent soil erosion in the steep slope area**.**	79 (73.15)	28 (25.93)	1 (0.93)	2.72	High
2.3 Distance from an agrochemical field					

Table 4.6 Perception of organic vegetable production

Detail of practices	Level of perception (%)				
	High	Medium	Low	Mean	Level
- Vegetable garden and fruit orchard must be located at least 1-8 meters away from farm field under agrochemical use.	68 (62.96)	25 (23.15)	15 (13.89)	2.49	High
- Rice field must be located at least 1-8 meters away from a farm field under agrochemical use.	72 (66.67)	35 (32.41)	1 (0.93)	2.66	High
2.4 How to prevent chemical contaminants via wind					
- Vegetable garden and fruit orchard must have plants as a windbreaker or barrier at least 1-8 meters wide.	49 (45.37)	56 (51.85)	3 (2.78)	2.43	High
- Rice field must have plants barrier at least 1-8 meters wide.	38 (35.19)	61 (56.48%)	9 (8.33)	2.27	Medium
2.5 Insect attractant and repellent plants					
- Plant insect attractant and repellent plants spreading throughout 1% of the field.	35 (32.41)	58 (53.70)	15 (13.89)	2.19	Medium
2.6 Biodiversity					
- There must be at least 10 types of plants and living organisms that are useful in the area proposed for approval.	57 (52.79)	46 (42.59)	5 (4.63)	2.48	High
2.7 Collection, selection, and improvement of native plants					
- Collect, select, and improve native plants continuously.	42 (38.89)	59 (54.63)	7 (6.48)	2.32	Medium
2.8 Genetically Modified Organisms					
- Do not plant, raise, or use genetically modified organisms in the field.	85 (78.70)	19 (17.59)	4 (3.70)	2.75	High
Total	-	-	-	2.45	High
3. Soil					
3.1 Soil improvement					
- Use only organic fertilizers for plantation.	108	-	-	3.00	High
- Raise animals to use as an organic source with the appropriate number that balance with the farming area.	87 (80.56)	21 (19.44)	-	2.81	High

Table 4.6 Perception of organic vegetable production

Detail of practices	Level of perception (%)				
	High	**Medium**	**Low**	**Mean**	**Level**
- Record purchase confirmation of organic matter supplement on the farm account.	93 (86.11)	8 (7.41)	7 (6.48)	2.80	High
- Always ferment organic matters before using	87 (80.56)	21 (19.44)	-	2.81	High
- Planting crop for soil fertility.	83 (76.85)	25 (23.15)	-	2.77	High
- Planting cover crops to improve soil.	92 (85.19)	16 (14.81)	-	2.85	High
3.2 Soil conservation					
- Do not use chemical fertilizers.	108	-	-	3.00	High
- Do not burn dead plants/ organic matters in the farm.	90 (83.33)	15 (13.89)	3 (2.78)	2.81	High
- Do not use genetically engineered microbes.	75 (69.44)	14 (12.96)	19 (17.59)	2.52	High
3.3 Environment and Soil Fertility					
- There are earthworms or living organisms in the soil.	86 (79.63)	12 (11.11)	10 (9.26)	2.70	High
- Organic matters can be found in the soil at least 2%.	85 (78.70)	17 (15.74)	6 (5.56)	2.73	High
- Soil is friable.	92 (85.19)	9 (8.33)	7 (6.48)	2.79	High
Total	**-**	**-**	**-**	2.80	High
4. Fertilizers management					
4.1 Organic matter					
- Always ferment organic matters before using (e.g. manure).	93 (86.11)	14 (12.96)	1 (0.93)	2.85	High
- Do not use manure from non-organically raised livestock.	87 (80.56)	21 (19.44)	-	2.81	High
- Document usage information including time of usage and source of manure.	76 (70.37)	15 (13.89)	17 (15.74)	2.55	High
- Do not use organic fertilizer as a precursor or a composition.	108	-	-	3.00	Medium
- Do not use heavy metals-contaminated organic fertilizer.	93 (86.11)	12 (11.11)	3 (2.78)	2.83	High
- Do not use waste from urban area or municipality.	73 (67.59)	14 (12.96)	21 (19.44)	2.48	High
- Do not use excrement.	81 (75.00)	17 (15.74)	10 (9.26)	2.66	High

Table 4.6 Perception of organic vegetable production (continued)

Detail of practices	Level of perception (%)				
	High	Medium	Low	Mean	Level
- Do not blend slick or inked paper in organic fertilizer.	96 (88.89)	9 (8.33)	3 (2.78)	2.86	High
- Do not use waste from industrial factory	95 (87.96)	11 (10.19)	2 (1.85)	2.86	High
Total	-	-	-	2.45	High
5. Weed and pest					
5.1 Weed management					
- Do not cover soil with biodegradable plastic.	76 (70.37)	27 (25.00)	5 (4.63)	2.66	High
- Do not use weed control chemicals or herbicide.	97 (89.81)	11 (10.19)	-	2.90	High
5.2 Plant diseases and pest					
- Restore agricultural environment by planting attractant and repellent plants and crop rotation.	102(94.44)	6 (5.56)	-	2.94	High
- Do not use herbal extracts and prohibited substances according to transitory provision.	85 (78.70)	14 (12.96)	9 (8.33)	2.70	High
- There should be a biodiversity all over the area.	93 (86.11)	8 (7.41)	7 (6.48)	2.80	High
- Do not use detergents or synthetic chemical sticking agent or synthetic chemical hormones.	108	-	-	3.00	High
- Do not use machines or equipment that were used in orchard where chemical inputs were applied.	105(97.22)	3 (2.78)	-	2.97	High
Total	-	-	-	2.85	High
6. Seed and propagation					
6.1 Seed					
- Do not use chemically preserved seeds.	108	-	-	3.00	High
6.2 Propagation					
- Do not use chemical hormones in seed dressing or propagation.	108	-	-	3.00	High

Table 4.6 Perception of organic vegetable production (continued)

Detail of practices	Level of perception (%)				
	High		High		High
- Use only perennial plant branches or reproduction parts of organic garden. Branches from chemically tainted garden can be used if the garden has stopped using chemicals for at least 12 months.	83 (88.89)	12 (11.11)	13 (12.04)	2.65	Medium
- Do not use seeds, branches, perennial plant of genetically modified crops.	104(96.30)	4 (3.70)	-	2.96	High
Total	-	-	-	2.90	High
7. Water management					
7.1 Prevention of chemical contaminants in water					
- Water clarifier is required if a shared water supply is used with orchard where chemical inputs were applie.	95 (87.96)	13 (12.04)	-	2.88	High
- Rice field requires water clarifier or use buffer garden as a water clarifier.	78 (72.22)	11 (10.19)	19 (17.59)	2.55	High
- Waste water treatment system is required.	98 (90.74)	10 (9.26)	-	2.91	High
- Do not use sewage treatment residues	83 (76.85)	14 (12.96)	11 (10.19)	2.67	Medium
Total	-	-	-	2.75	High
8. Harvesting and marketing					
8.1 Harvesting					
- Do not use harvest equipment that were used in chemical garden. In case of necessity, decontamination is needed.	105(97.22)	3 (2.78)	-	2.97	High
- Keep harvested products, containers, and storage clean.	93 (86.11)	15 (13.89)	-	2.86	High
8.2 Storage and curing					
- Do not use shared storage with harvested chemically tainted products	108	-	-	3.00	High
- Do not use curing accelerators	108	-	-	3.00	High
8.3 Transportation					

Table 4.6 Perception of organic vegetable production (continued)

Detail of practices	Level of perception (%)				
	High	Medium	Low	Mean	Level
- Do not share equipment and truck with chemical products. In case of necessity, one must prevent contamination.	108	-	-	3.00	High
8.4 Post harvesting					
- Do not use chemicals to extend shelf-life or clean.	108	-	-	3.00	High
8.5 Marketing					
- Label standard mark on the products prominently.	108	-	-	3.00	High
- Place organic products separate from chemically tainted products	108	-	-	3.00	High
Total	-	-	-	2.98	High

Source: The North Organic Standard Association (NOSA), 2008.

4.9 Farmer adaptation towards organic vegetable farming systems

This topic is presenting the results and discussions regarding farmers' adaptation in organic vegetable farming in the studied areas. The detailed information and results gained from each practice process are used to assess perception of organic vegetable production systems and are furthermore presented and discussed in this part. Afterwards, the overall organic practice scores are presented in average percentage. There are eight main practices related to organic vegetable production being discussed. The implication of this finding is that organic vegetable farming adoption has potential in the studied area if farmers are encouraged and motivated through adequate training.

1. Cultivated field background

1.1) Duration of chemical disuse

Farmers, 78.7% practiced according to the statement that follow about an area which chemicals never been used must perform organic agriculture for at least 6

months. They check and select their farm which chemicals never been used must perform organic agriculture before they farm their organic vegetable.

Farmers practiced 53.7% follow in the annual crop field; the duration of chemical disuse must be longer than 12 months.

Farmers practiced 70.37% follow about in the perennial field; the duration of chemical disuse must be longer than 18 months.

Farmers practiced 86.11% follow about farmer must perform organic agriculture for 36 months in order to be approved as an organic agriculture (Since applying for approval). It is a standard for the transition period.

1.2) Regulations after approval acquired

Farmers practiced 43.52% follow about the approved farmers must convert all cultivated areas to organic agriculture within 4 years. A written plan of conversion is required.

2) Overall condition of the fields

2.1) Deforestation

Farmers practiced 100% follow about do not encroach on forest area. If the cultivated area is in the forest area, document of right is required (e.g. a document which is approved by the government or local or local administration). The most farmers had land in the village so they did not encroach on forest area.

2.2) Soil conservation and soil erosion prevention

Farmers practiced 66.67% follow about ground cover plants are needed to help prevent soil erosion in the steep slope area. Some farmers grown cover plants in the area but some area was not slope zone so they did not grow cover plants.

2.3) Distance from an agrochemical field

Farmers practiced 59.26% follow about vegetable garden and fruit orchard must be located at least 1-8 meters away from an agrochemical field. That was very hard to follow because the land not the same characteristic in every area so some farmers can do it but some farmers cannot follow this point but try to do the best.

Farmers practiced 73.15% follow about rice field must be located at least 1-8 meters away from an agrochemical field. That was very hard to follow because the land not the same characteristic in every area so some farmers can do it but some farmers cannot follow this point but try to do the best.

2.4) Way to prevent chemical contaminants via wind

Farmers practiced 33.33% follow about vegetable garden and fruit orchard must have plants as a windbreaker or barrier at least 1-8 meters wide. That is very hard to follow because the land not the same characteristic in every area so some farmers can do it but some farmers cannot follow this point but try to do the best.

Farmers practiced 28.70% follow about rice field must have plants barrier at least 1-8 meters wide. That was very hard to follow because the land not the same characteristic in every area so some farmers can do it but some farmers cannot follow this point but try to do the best.

2.5) Insect attractant and repellent plants

Farmers practiced 39.81% follow about plant insect attractant and repellent plants spreading throughout 1% of the field. The most areas, farmers grown vegetables around for consumption and sold so they seldom grown plant insect attractant and repellent plants.

2.6) Biodiversity

Farmers practiced 100% follow about there must be at least 10 types of plants and living organisms that are useful in the area that applying for approval. Base on organic production the farmers always found the biodiversity around.

2.7) Collection, Selection, and Improvement of native plants

Farmers practiced 34.26% follow about collect, select, and improve native plants continuously. Some farmers bought the seed or plants from member or gain free from NGO or government so less of them collect, select, and improve native plants.

2.8) Genetically Modified Organisms

Farmers practiced 100% follow about do not plant, raise, or use genetically modified organisms in the field. In this point the farmers never do it before. They were native organic farmers.

3) Soil

3.1) Soil improvement

Farmers practiced 100% follow about use only organic fertilizers for plantation. This is the organic way so the farmers adapted it in their vegetable production by using compost or green manure.

Farmers practiced 79.63% follow about raise animals to use as an organic source with the appropriate number that balance with the farming area. This was the organic way so the farmers adapted it in their vegetable production by raising chicken, cows, fishes or buffaloes for manure and ecology way.

Farmers practiced 43.52% follow about record purchase confirmation of organic matter supplement on farming account. The farmers who had high education they would do it but some farmers did not do it because of their education and time.

Farmers practiced 57.40% follow about always ferment organic matter before using. This was the organic way so the farmers adapted it in their vegetable production by fermenting compost and making bio-extract.

Farmers practiced 85.19% follow about planting crop for soil fertility. This was the organic way so the farmers adapted it in their vegetable production by planting peanut for soil fertility.

3.2) Soil conservation

Farmers practiced 100% follow about do not use chemical fertilizers. This was the organic way so the farmers adapted it in their vegetable production by using compost and manure instead chemical fertilizer.

Farmers practiced 56.48% follow about do not burn dead plants/organic matter in the farm. Some farmers were still burn straw or dry grass after harvest that was the easy way to manage farm.

Farmers practiced 100% follow about do not use genetically engineered microbes. This was the organic way so the farmers adapted it in their vegetable production by using bio-extract from native plant for weed or pest management.

3.3) Environment and Soil Fertility

Farmers practiced 84.26% follow about there are earthworms or living organisms in the soil. The farmers can find earthworms in the soil of their farm that was benefit for soil improvement.

Farmers practiced 36.11% follow about organic matter can be found in the soil at least 2%. The farmers do not check for this frequently so they didn't know how much organic matter in the soil.

Farmers practiced 78.70% follow about soil is friable. This is the organic way so the farmers adapted it in their vegetable production by plough the soil and apply manure for soil improvement.

4) Fertilizer management

4.1) Organic matter

Farmers practiced 59.26% follow about organic matter which always practices in using manure or other methods to improve soil fertility. This is the organic way so the farmers adapted it in their vegetable production by making organic fertilizer from sewage vegetable and manure.

Farmers practiced 66.67% follow about do not use manure from chemical livestock. This was the organic way so the farmers adapt it in their vegetable production by using manure from their livestock or buy it from member. The addition of livestock manure to improve soil and crop productivity also stimulates higher populations of soil microorganisms which compete with or destroy soil pathogens.

Farmers practiced 21.30% follow about document usage information including time of usage and source of manure. Some farmers did not have enough time to do it so this point had less farmers adapted to do.

Farmers practiced 100% follow about do not use organic fertilizer as a precursor or a composition. This was the organic way so the farmers adapt it in their vegetable production.

Farmers practiced 31.48% follow about do not use heavy metals-contaminated organic fertilizer. This was the organic way so the farmers adapt it in their vegetable production by using organic fertilizer that they produced from natural inputs.

Farmers practiced 70.37% follow about do not use waste from urban area or municipality. This was the organic way so the farmers adapted it in their vegetable

production by did not using waste from urban area or municipality in their production.

Farmers practiced 100% follow about do not use excrement because it was not organic way and not allowed using in organic production.

Farmers practiced 100% follow about do not blend slick or inked paper in organic fertilizer because it was not organic way and not allowed using in organic production.

Farmers practiced 100% follow about do not use waste from industrial factory because it was not organic way and not allowed using in organic production.

5) Weed and pest

5.1) Weed management

Farmers practiced 45.37% follow about do not cover soil with biodegradable plastic. The farmers always use crop rotation and for weed management. Crop rotations are the basis for successful organic farming and are necessary for breaking weed, insect, and disease cycles. Cultivation must be completed with properly set equipment under soil conditions that are not conducive to compaction.

Farmers practiced 100% follow about do not use chemical weed control or herbicide. Organic farmers used a wide variety of tools and strategies to control weeds without synthetic chemicals.

5.2) Plant diseases and pest management

Farmers practiced 79.63% follow about restore agricultural environment by planting attractant and repellent plants and crop rotation. Rotation of susceptible and resistant crops is one of the oldest practices used to control disease. It remains an important practice against many diseases, where a specific control, such as host resistance, is not available. Rotation is particularly effective in controlling soil and stubble borne diseases.

Farmers practiced 67.60% follow about do not use herbal extracts and prohibited substances according to transitory provision. Some farmers did not know which one is herbal extracts and prohibited substances so they were not sure that they used to use them or not.

Farmers practiced 89.81% follow about there should be a biodiversity all over the area. That was the organic circumstance had to have a lot of plants and animals around the area.

Farmers practiced 100% follow about do not use detergents or synthetic chemical sticking agent or synthetic chemical hormones. They used natural inputs such as bio extract spray through the plots.

Farmers practiced 57.41% follow about do not use machines or equipment that was used in chemical garden. That was the problem of farmers that they did not strict to use the equipment so they adapt this point not too much.

6) Seed and propagation

6.1) Seed

Farmers practiced 100% follow about do not use chemical to preserved seeds. They use seed from their last season and gain from NGO or government. So it was not contaminating from chemical.

6.2) Propagation

Farmers practiced 100% follow about do not use chemical hormones in seed dressing or propagation. This was the organic way so the farmers adapted it in their vegetable production.

Farmers practiced 80.56% follow about use only perennial plant branches or reproduction parts of organic garden. Branches from chemical garden can be used if the garden has stop using chemical for at least 12 months. This was the organic way so the farmers adapted it in their vegetable production.

Farmers practiced 100% follow about do not use seeds, branches, perennial plant of genetically modified crops. This was the organic way so the farmers adapted it in their vegetable production.

7) Water management

7.1) Prevention of chemical contaminants in water

Farmers practiced 82.41% follow about water clarifier is required if a shared water supply is used with chemical garden. The farmers built water clarifier for using in their farm.

Farmers practiced 65.74% follow about rice field requires water clarifier or use buffer garden as a water clarifier. And farmers practiced 51.85% follow about waste water treatment system is required. This was the organic way so the farmers adapted it in their vegetable production.

Farmers practiced 84.26% follow about do not use sewage treatment residues. Farmers used water from irrigation and raining.

8) Harvesting and marketing

8.1) Harvesting

Farmers practiced 100% follow about do not use harvest equipment that was used in chemical garden. In case of necessity, decontamination is needed. Farmers practiced 87.96% follow about keep harvested products, containers, and storage clean. Farmers practiced organic so they didn't have contaminated equipment from chemical.

8.2) Storage and curing

Farmers practiced 100% follow about do not use shared storage with harvested chemical products. Farmers practiced 100% follow about do not use curing accelerators. This was the organic way so the farmers adapt it in their vegetable production. The farmers harvested their products in the evening for selling in the morning so they kept products in refrigerator or packages.

8.3) Transportation

Farmers practiced 90.74% follow about do not share equipment and truck with chemical products. In case of necessity, it must prevent contamination. They transported their products with the products of their member so the products could not come with chemical products.

8.4) Post harvesting

Farmers practiced 100% follow about do not use chemicals to extend shelf-life or clean. This was the organic way so the farmers adapted it in their vegetable production.

8.5) Marketing

Farmers have practiced 73.15% follow about label standard mark on the products prominently. Farmers practiced 100% follow about place organic products separate from chemical products. This was the organic way so the farmers adapted it in their vegetable production. And the group had their sticker for label on the package.

Table 4.7 Farmer adaptation for organic vegetable farming systems

Detail of practices	Practice n=108 (%)	Not practice n=108 (%)
1.Cultivated field background		
1.1 Duration of chemical disuse		
- An area where chemicals have never been used in order to perform organic agriculture for at least 6 months.	85 (78.70)	23 (21.30)
- In the annual crop field, the duration of chemical disuse must be longer than 12 months.	58 (53.70)	50 (46.30)
- In the perennial field, the duration of chemical disuse must be longer than 18 months.	76 (70.37)	32 (29.63)
- A farmer must perform organic agriculture for 36 months in order to be approved as an organic agriculture (Since the time applying for approval). It is a standard for the transition period.	93 (86.11)	15 (13.89)
1.2 Regulations after approval acquired		
- The approved farmers must convert all cultivated areas to organic agriculture within 4 years. A written plan of conversion is required.	47 (43.52)	61 (56.48)
2. Overall condition of the fields		
2.1 Deforestation		
- Do not encroach on forest area. If the cultivated area is in the forest area, document of right is required (e.g. a document which is approved by the government or local administration organization).	108 (100)	-
2.2 Soil conservation and soil erosion prevention		
- Ground cover plants are needed to help prevent soil erosion in the steep slope area.	72 (66.67)	36 (33.33)
2.3 Distance from an agrochemical field		
- Vegetable garden and fruit orchard must be located at least 1-8 meters away from farm field under agrochemical use.	64 (59.26)	44 (40.74)
- Rice field must be located at least 1-8 meters away from a farm field under agrochemical use.	79 (73.15)	29 (26.85)

Table 4.7 Farmer adaptation for organic vegetable farming systems (continued)

Detail of practices	Practice n=108 (%)	Not practice n=108 (%)
2.4 How to prevent chemical contaminants via wind		
- Vegetable garden and fruit orchard must have plants as a windbreaker or barrier at least 1-8 meters wide.	36 (33.33)	72 (66.67)
- Rice field must have plants barrier at least 1-8 meters wide.	31 (28.70)	77 (71.30)
2.5 Insect attractant and repellent plants		
- Plant insect attractant and repellent plants spreading throughout 1% of the field.	43 (39.81)	65 (60.19)
2.6 Biodiversity		
- There must be at least 10 types of plants and living organisms that are useful in the area proposed for approval.	108 (100)	-
2.7 Collection, selection, and improvement of native plants		
- Collect, select, and improve native plants continuously.	37 (34.26)	71 (65.74)
2.8 Genetically Modified Organisms		
- Do not plant, raise, or use genetically modified organisms in the field.	108(100.00)	-
3. Soil		
3.1 Soil improvement		
- Use only organic fertilizers for plantation.	108 (100)	-
- Raise animals to use as an organic source with the appropriate number that balance with the farming area.	86 (79.63)	22 (20.37)
- Record purchase confirmation of organic matter supplement on the farm account.	47 (43.52)	61 (56.48)
- Always ferment organic matters before using	62 (57.40)	46 (42.60)
- Planting crop for soil fertility.	92 (85.19)	16 (14.81)
- Planting cover crops to improve soil.	82 (75.93)	26 (24.07)
3.2 Soil conservation		
- Use only organic fertilizers for plantation.	108 (100)	-
- Raise animals to use as an organic source with the appropriate number that balance with the farming area.	86 (79.63)	22 (20.37)

Table 4.7 Farmer adaptation for organic vegetable farming systems (continued)

Detail of practices	Practice n=108 (%)	Not practice n=108 (%)
- Record purchase confirmation of organic matter supplement on the farm account.	47 (43.52)	61 (56.48)
- Always ferment organic matters before using	62 (57.40)	46 (42.60)
- Planting crop for soil fertility.	92 (85.19	16 (14.81)
- Planting cover crops to improve soil.	82 (75.93)	26 (24.07)
3.2 Soil conservation		
- Do not use chemical fertilizers.	108(100.00)	-
- Do not burn dead plants/ organic matters in the farm.	61 (56.48)	47 (43.52)
- Do not use genetically engineered microbes.	108(100.00)	-
3.3 Environment and Soil Fertility		
- There are earthworms or living organisms in the soil.	91 (84.26)	17 (15.74)
- Organic matters can be found in the soil at least 2%.	39 (36.11)	69 (63.89)
- Soil is friable	85 (78.70)	23 (21.30)
4. Fertilizers management		
4.1 Organic matter		
- Always ferment organic matters before using (e.g. manure).	64 (59.26)	44 (40.74)
- Do not use manure from non-organically raised livestock.	72 (66.67)	36 (33.33)
- Document usage information including time of usage and source of manure.	23 (21.30)	85 (78.70)
- Do not use organic fertilizer as a precursor or a composition.	108(100.00)	-
- Do not use heavy metals-contaminated organic fertilizer.	34 (31.48)	74 (68.52)
- Do not use waste from urban area or municipality.	76 (70.37)	32 (29.63)
- Do not use excrement.	108(100.00)	-
- Do not blend slick or inked paper in organic fertilizer.	108(100.00)	-
- Do not use waste from industrial factory	108(100.00)	-
5. Weed and pest		
5.1 Weed management		
- Do not cover soil with biodegradable plastic.	49 (45.37)	59 (54.63)
- Do not use weed control chemicals or herbicide.	108(100.00)	-

Table 4.7 Farmer adaptation for organic vegetable farming systems (continued)

Detail of practices	Practice n=108 (%)	Not practice n=108 (%)
5.2 Plant diseases and pest		
- Restore agricultural environment by planting attractant and repellent plants and crop rotation.	86 (79.63)	22 (20.37)
- Do not use herbal extracts and prohibited substances according to transitory provision.	73 (67.60)	35 (32.40)
- There should be a biodiversity all over the area.	97 (89.81)	11 (10.19)
- Do not use detergents or synthetic chemical sticking agent or synthetic chemical hormones.	108(100.00)	-
- Do not use machines or equipment that was used in orchard where chemical inputs were applied	62 (57.41)	46 (42.59)
6. Seed and propagation		
6.1 Seed		
- Do not use chemically preserved seeds.	108(100.00)	-
6.2 Propagation		
- Do not use chemical hormones in seed dressing or propagation.	108(100.00)	-
- Use only perennial plant branches or reproduction parts of organic garden. Branches from chemically tainted garden can be used if the garden has stopped using chemicals for at least 12 months.	87 (80.56)	21 (19.44)
- Do not use seeds, branches, perennial plant of genetically modified crops	108(100.00)	-
7. Water management		
7.1 Prevention of chemical contaminants in water		
- Water clarifier is required if a shared water supply is used with orchard where chemical inputs were applied.	89 (82.41)	19 (17.59)
- Rice field requires water clarifier or use buffer garden as a water clarifier.	71 (65.74)	37 (34.26)

Table 4.7 Farmer adaptation for organic vegetable farming systems (continued)

Detail of practices	Practice n=108 (%)	Not practice n=108 (%)
- Waste water treatment system is required.	56 (51.85)	2 (48.15)
- Do not use sewage treatment residues	91 (84.26)	17 (15.74)
8. Harvesting and marketing		
8.1 Harvesting		
- Do not use harvest equipment that was used in chemical garden. In case of necessity, decontamination is needed.	108(100.00)	-
- Keep harvested products, containers, and storage clean.	95 (87.96)	13 (12.04)
8.2 Storage and curing.		
- Do not use shared storage with harvested chemically tainted products	108(100.00)	-
- Do not use curing accelerators	108(100.00)	-
8.3 Transportation		
- Do not share equipment and truck with chemical products. In case of necessity, one must prevent contamination.	98(90.74)	10(9.26)
8.4 Post harvesting		
- Do not use chemicals to extend shelf-life or clean.	108(100.00)	-
8.5 Marketing		
- Label standard mark on the products prominently.	79 (73.15)	29 (26.85)
- Place organic products separate from chemically tainted products.	108(100.00)	-

Source: Survey, 2013

4.10 Factors influencing perception of organic vegetable farming systems

This study used multiple regression analysis in order to determine the relationship between independent variables and dependent variable. The independent variables are age of household head, gender, number of labor, household head's education, experience, income, debt, land size, extension officer's field visits, farmers' networks or membership in organic vegetable production group, farmers' training in organic activities and sources of knowledge. The dependent variable is farmers' perception of organic vegetable farming.

The results of preliminary analysis on the variables that were included in the regression equation revealed that average farmer as male, explanatory 50.30 years old, with primary school education, earning 1.32 household labors, having experience in growing organic vegetables, 54,177.31 baht per year from agriculture, with 22133.33 baht indebtedness, holding 1.80 rais of farmland, getting contact with the extension officers 2.91 times per year, being member of 2.94 farming related groups, receiving organic training 3.81 times per year, and receiving knowledge concerning organic agriculture from 4.82 sources in Table 4.8 presented the summary statistics of the explanatory variables.

Table 4.8 Mean and standard deviation of the variables (perception)

Variable	Mean	Std. Deviation
1. Age of farmers	50.30	10.146
2. Gender	1.47	0.502
3. Household head educational level	1.58	0.725
4. Number of labor	1.32	0.561
5. Experience	2.00	7.97
6. Farm income	54,177.31	20,400.380
7. Debt	22,133.33	15,832.795
8. Land size	1.80	0.806
9. Extension visit	2.91	1.028
10. Farmers' networks or membership in organic vegetable production groups	2.94	1.763
11. Farmers' training in organic activities	3.81	1.463
12. Sources of knowledge	4.82	2.418

Dependent Variable: Perception

The parameters and the corresponding definitions for multiple regression estimation and analysis are a follow:

Y1 = farmers' perception towards organic vegetable farming

β_0 = constant or intercept term

$\beta_1, \beta_2, \beta_n$ = coefficients of the estimate

e = random error term

X_1 = Age of household head

X_2 = Gender

X_3= Household head educational level

X_4 = Number of labor

X_5 = Experience

X_6 = Farm income

X_7 = Debt

X_8 = Land size

X_9= Extension visit

X_{10}= Farmers' networks or membership in organic vegetable production group

X_{11}= Farmers' training in organic activities

X_{12}= Sources of knowledge

Table 4.9 shows the correlation matrix of variables in the regression model and it can be seem that no pair of variables has correlation value above 0.80 when will violate the assumptions of multiple regression analysis and cause the problem of Multicollinearity.

Table 4.9 The relationships among the variables used in multiple regression analysis. The dependent variable is the perception of organic vegetable production

Variables	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
Y	1.000	-.195	.132	.294	.304	.160	.186	.184	-.103	-.177	-.061	-.060	-.020
X_1		1.000	.150	.093	-.098	-.248	.193	.294	.105	.016	.020	-.139	.246
X_2			1.000	.058	.115	.047	-.003	.351	-.037	-.023	.141	-.014	.069
X_3				1.000	.197	-.194	.307	.094	-.243	.061	.015	-.068	.102
X_4					1.000	-.021	-.022	.155	.230	.117	-.083	-.196	-.219
X_5						1.000	-.062	.150	-.058	.080	.100	.305	.145
X_6							1.000	.131	-.146	.288	-.022	-.326	-.103
X_7								1.000	.279	.052	.123	.098	.085
X_8									1.000	.112	.089	-.002	-.162
X_9										1.000	-.055	.000	-.165
X_{10}											1.000	.223	.151
X_{11}												1.000	.379
X_{12}													1.000

The analysis of multiple regression by taking variables into the equation then calculated as the normal methodology (Enter) appear that F = 4.456 Sig. = 0.000, apparently at least one independent variable that is statistically significant in explaining with the dependent variable. (Farmers' perception of organic vegetable production). The coefficient of determination; R^2 = .36 from the esimation means that all independent variables can explain 36.0% of the variability of the dependent variable. Meanwhile, among 12 independent variables, those found to have effect on the dependent variable at the 0.05 level of statistical significance were (1) age (2) education level (3) household labor (4) farm income and (5) extension visit as detailed in Table 4.13. The estimated regression equation is as in the following:

$$\mathbf{Y_1 = 1.926 - .011X_1 + .072X_2 + .149X_3 + .221X_4 + .105X_5 + 5.990E\text{-}6X_6 + 4.572E\text{-}6\ X_7 - .021X_8 - .149X_9 - .026X_{10} + .005X_{11} - .003X_{12}}$$

4.11 Factors in fluencing adaptation forwards organic vegetable farming systems

Another multiple regression analysis was performed to determine the relationship between independent variables and dependent variable. The independent variables are age of household head, gender, number of labor, household head's education, experience, soil fertility, source of water, income, indebtedness, land size, extension officer field visits, farmers' networks or membership in organic vegetable production groups, farmers training in organic activities and sources of knowledge. The dependent variable is farmers' adaptation forwards organic vegetable farming.

The results of a preliminary analysis on the independent variables revealed that the average farmer was male, 50.30 years old, with primary school, having 1.32 household labors, having experience in growing organic vegetables, farming in good soil fertility, using irrigation and natural water sources for growing organic vegetables, earning 54,177.31 baht per year from agriculture, incurring 22,133.33 baht debt, holding 1.80 rais of farm land, getting contact with the extension officers 2.91 times per year, joining or being member agricultural related 2.94 groups, receiving organic training 3.81 times per year, and receiving knowledge concernig organic

activities from 4.82 sources. Table 4.10 provides the summary statistics of variables under study.

Table 4.10 Mean and standard deviation of the variables (adaptation)

Variable	Mean	Std. Deviation
1. Age of household head	1.47	0.502
2. Gender	50.30	10.146
3. Household head's educational level	1.58	0.725
4. Number of labor	1.32	0.561
5. Experience	2.00	7.97
6. Soil fertility	1.83	0.881
7. Irrigation	0.66	0.477
8. Natural water	0.14	0.347
9. Farm income	54,177.31	20,400.380
10. Debt	22,133.33	15,832.795
11. Land size	1.80	0.806
12. Extension visit	2.91	1.028
15. Sources of knowledge	4.82	2.418

Dependent Variable: Adaptation

The relationship between each pair of variables evidently, there is no pairs of variables having correlation value above 0.80 which will Multicollinearity problem and these violate the assumptions for multiple regression analysis. Therefore, an Ordinary Least Squares estimation can be undertaken. The parameters and the corresponding definitions for the multiple regression analysis are:

Y2 = farmers' adaptation towards organic vegetable farming

β_0 = the constant or intercept term

$\beta_1, \beta_2, \beta_n$ = coefficients of the estimate

e = random error term

X_1 = Age of household head

X_2 = Gender

X_3= Household head's educational level

X_4 = Number of labor

X_5 = Experience

X_6 = Soil fertility

X_7 = Irrigation

X_8= Natural water

X_9= Farm Income

X_{10} = Debt

X_{11} = Land size

X_{12}= Extension visit

X_{13}= Farmers' networks or membership in organic vegetable production

X_{14}= Farmers training in organic activities

X_{15}= Sources of knowledge

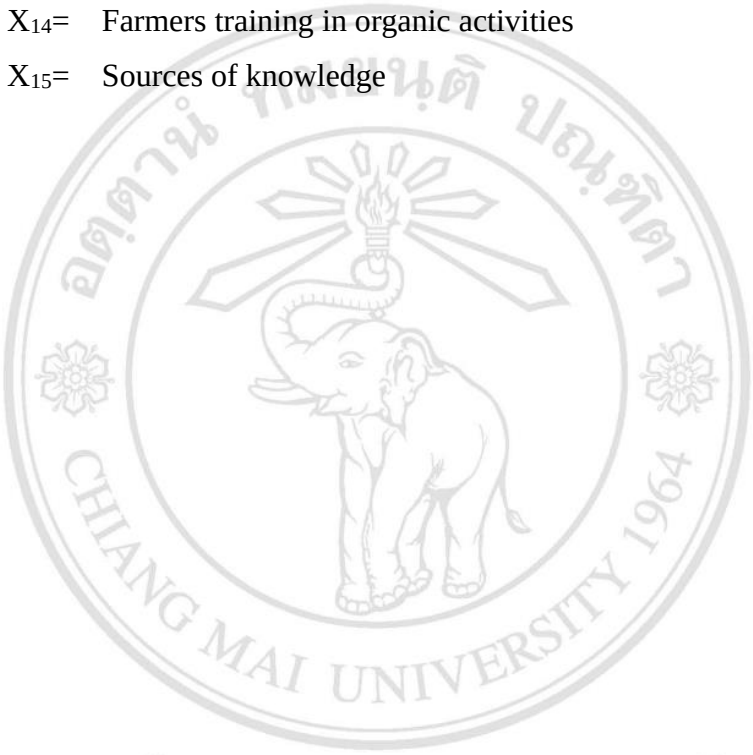

Table 4.11 The relationships among the variables used in multiple regression analysis. The dependent variable is the adaptation toward organic vegetable production

Variables	**Y**	**X_1**	**X_2**	**X_3**	**X_4**	**X_5**	**X_6**	**X_7**	**X_8**	**X_9**	**X_{10}**	**X_{11}**	**X_{12}**	**X_{13}**	**X_{14}**	**X_{15}**
Y	1.000	-.012	-081	.290	.010	-.344	-.095	.132	-.302	-022	-.023	-.044	-.113	.243	.009	.085
X_1		1.000	.150	.093	-.098	-.248	-.235	-.077	.084	.193	.294	.105	.016	.020	-.139	.246
X_2			1.000	.058	.115	.074	-.138	-.177	-.004	-.003	.351	-.037	-.023	.141	-.014	.069
X_3				1.000	.197	-.194	.051	.016	-.028	.307	.094	-.243	.061	.015	-.068	.102
X_4					1.000	-.021	-.022	-.140	.007	-.022	.155	.230	.117	-.083	-.196	-.219
X_5						1.000	.106	-.246	.067	-.062	.150	-.058	.080	.100	.305	.145
X_6							1.000	-.048	.229	.152	.090	.070	.323	.131	.141	-.110
X_7								1.000	-.556	.228	-.134	-.208	.068	-.082	-.110	.336
X_8									1.000	.109	.133	.235	.141	-.046	-.112	.052
X_9										1.000	.131	-.146	.288	-.022	-.326	-.013
X_{10}											1.000	.279	.052	.123	.098	.085
X_{11}												1.000	.112	.089	-.002	-.162
X_{12}													1.000	-.055	.000	-.165
X_{13}														1.000	.223	.151
X_{14}															1.000	.379
X_{15}																1.000

The following regression equation was resulted from the estimation:

$$\mathbf{Y_2 = 57.693 - .184X_1 - 3.334X_2 + 3.231X_3 - .993X_4 - 4.756X_5 - 1.112X_6 - 2.517X_7 - 9.152X_8 -}$$

$$\mathbf{1.984E\text{-}5X_9 + 8.329E\text{-}5X_{10} + .264X_{11} + .279X_{12} + 1.508X_{13} - .400X_{14} + .434X_{15}}$$

The analysis of multiple regression by taking variables into the equation then calculated as the normal methodology (Enter) appear that F = 3.658 Sig. = 0.000, indicating that the independent variables apparently at least one independent variable that is statistically significant relationship with the dependent variable. (Farmers' adaptation in organic vegetable production) and considering the coefficients of multiple coefficient of determination; R^2 = .374 means that all independent variables explain the variability of the dependent variable were at 37.4%. Among the 15 independent variables included in the estimation, only four had the effect on the dependent variable at the 0.05 statistically significant levels namely (1) education level (2) experience (3) natural water (4) farmers' networks or membership.

Table 4.12 Multiple regression analysis of effects livelihood assets on perception and adaptation concerning organic vegetable farming systems in the selected areas

Variables	**Unstandardized Coefficients**			
Perception	**B**	**Std. Error**	**t**	**Sig.**
Constant	1.926	.387	4.981	.000
Age of farmer	-.011	.005	-.2358	**.020**
Gender	.072	.089	.800	.426
Education	.149	.066	2.267	**.026**
Labor	.221	.083	2.657	**.009**
Experience	.105	.059	1.781	.078
Farm income	5.990E-6	.000	2.439	**.017**
Debt	4.572E-6	.000	1.428	.156
Land size	-.021	.060	-.348	.728
Extension visit	-.149	.044	-3.421	**.001**
Network	-.026	.024	-1.080	.283
Training	.005	.036	.142	.887
Sources of knowledge	.003	.020	-.168	.867
Adaptation	**B**	**Std. Error**	**t**	**Sig.**
Constant	57.693	9.136	6.315	.000
Gender	-3.344	1.867	-1.791	.077
Age of farmer	-.187	.101	-1.818	.072
Education	3.231	1.338	2.415	**.018**
Labor	-.993	1.732	-.573	.568
Experience	-4.756	1.245	-3.821	**.000**
Soil fertility	-1.112	1.113	-.999	.320
Irrigation	-2.517	2.659	-.946	.346
Natural water	-9.152	3.250	-2.816	**.006**
Farm income	-1.984E-5	.000	-.375	.708
Debt	8.329E-5	.000	1.263	.210
Land size	.264	1.270	.208	.836

Table 4.12 Multiple regression analysis of effects livelihood assets on perception and adaptation concerning organic vegetable farming systems in the selected areas (Continued)

Variables	**Unstandardized Coefficients**			
Extension visit	.279	.922	.303	.763
Network	1.508	.498	3.031	**.003**
Training	-.400	.743	-.539	.591
Sources of knowledge	.434	.450	.964	.337

Discussion on Perception: R-squared = .360, SEE = .41844, F = 4.456, Sig. of F = .000

As this study mainly emphasized the livelihood strategies of organic vegetable farmers and these strategies are totally dependent on the accessibility to livelihood assets. Therefore, five capital assets are crucial to make detailed analysis on farmers' perception on organic vegetable production.

Results of multiple regression analysis depict that a number of factors were influencing farmers' perception of organic vegetable farming systems. Among all independent variables included in the model, five are significantly affecting farmers' perception of organic vegetable production. (Table 4.13)

Age of farmer was negative and significantly related to indicated farmers' perception about organic vegetable production at 5% level. This means that as the age of farmers decreased, access to organic vegetable production and perception increased and vice versa. A recent study showed those cocoa farmers' knowledge scores of integrated crop and pest management was negatively influenced by the farmer's age in Ashanti Region, Ghana (Soniia et al., 2011).The result is contrary to what Roger (2003) stated that young farmers are more willing to adopt a new innovation than an elder one because they are more open. However, in this study, older farmers turned out to be more open to changes.

The coefficient of **education** was positive and significantly related to indicated farmers' perception about organic vegetable production at 5% level. Therefore, it was apparent that farmers' education level favored acquisition of

knowledge and widened the knowledge horizon by getting exposed to extension officers and contacting other information sources and this finding was consistent with reports by others (Maraddi et al., 2007; Adeola 2010).

The coefficient of **labor** had positive sign and was significantly related to farmers' perception of organic vegetable production at 5% level while keeping other variables constant. This finding shows that the larger number of labor the greater more the farmers' perception of practicing organic vegetable production. Organic producers had to introduce several new tasks, some of them specific to organic agriculture such as soil-conservation measures, management practices, including the planting of new species of shade trees, and the manual control of weeds, pests and diseases and some of them are specifically required in order to obtain a product of higher quality. They frequently had higher harvesting costs because of the higher yields and more newly introduced new crops that demanded labor all year round. According to Kees Jensen (2000) it was found that one argument for supporting organic farming has been that it requires more labor and leads to higher rural employment. On the other hand, the high labor costs may constraint the development of the organic sector. Jensen's paper reviews the current knowledge about labor use change in the conversion to organic farming in Western Europe. It discusses how key concepts derived from feminist literature on rural women and agriculture can enlarge the existing knowledge of labor in organic farming which is mainly a product of farm management approaches.

The coefficient of **income** had positive sign and significant correlation with farmers' perception of organic vegetable production at 5% level and thus indicated that as the income increased, access to organic vegetable production information and perception increase. Farmers with low income had brought organic vegetable production into practices more than those with high income. This may be because they want to release indebtedness and increase more family income. Moreover, the farmers with high farm income had more knowledge and understanding than those who had low farm income. This may be due to those who had high farm income may be interested in receiving information and seek to additional knowledge which was one factor to increase family income. Other studies by Nowak and Korsching (1983) found that farmer characteristics such as perception of erosion, farm size, off-farm

employment and net income affected farmers' adoption of new practices, in particular, soil conservation practices.

Extension visit to organic farmers had negative coefficient value and significantly explained farmers' perception about organic vegetable production at 5% level. This indicated that those farmers, who had met extension officers continuously, would have lower degree of perception of organic vegetable farming systems because some extension officers did not provide organic information to them. In contrast, the findings of Chinaka et al. (2005) suggested that effectiveness of extension delivery could influence adoption and perception by farmers, and that poor extension delivery would lead to poor adoption and perception. This appears to support the view held by Olujide (2000) that before any innovation is introduced to farmers, their leaders' support should be sought so as to give legitimization to the agent to introduce the innovation.

The analysis revealed that there was a statistically significant relationship between farmers' perception of organic agriculture and the following factors: age, education, labor, income, and extension workers' visit. The results from the analysis can provide the foundation for the development of guidelines for supporting organic agricultural practices among farmers, generating innovation and introducing appropriate technology for each farming area to enhance production efficiency, strengthening the production capacity, and channeling the organic farm outputs to market systems which can lead to income creation in the local community. It is also imperative that the efforts to support and help solve problems concerning organic farming must adhere to the holistic principle by incorporating all aspects of innovative agricultural sciences in the organic farming systems. Ideally, the aspects to be addressed are the management and transfer process of knowledge and technology, soil nutrient improvement, water resource management, cultural practice management, selection of crop varieties suitable for growing in each locality, financial resource handling, management of farm labor in line with labor availability, pest management, plant protection, enhancement of crop vigor and health, pricing and marketing management to realize desirable output prices and occupational security, intensive farming practices with the use of knowledge in science and technology, and the linkage and network formation among farmers in various areas. The farmers' access

to agricultural extension services and pertinent government agencies as well as private organizations will directly be instrumental for farmers to adjust their production systems toward health concern and environmentally friendly direction, minimization of cost and agrochemical hazards, such that they can improve their income from organic outputs as well as distribute their organic produce and products to reach consumers at individual and organizational levels even including the buyers from their local communities. The change in consumers' behavior to become more health conscious and thus choose to buy more organic farm outputs will be a great incentive for farmers to continuingly expand their production for supplying to the consumers to a wider extent.

Adaptation: discussion on R-squared = .372, SEE = .41886, F = 3.941, Sig. of F = .000

As this study mainly emphasized on livelihood strategies of organic vegetable farmers and these strategies are totally dependent on the accessibility to livelihood assets. Therefore, five capital assets are crucial to make detail analysis of farmers' adaptation toward organic vegetable production.

Results of multiple regression analysis depict that a number of factors were influencing the adaptation toward organic vegetable farming systems. Among all independent variables included in the model four are significantly affecting farmers' adaptation toward organic vegetable production. (Table 4.13)

The coefficient of **education** come out positive and was significantly related to indicate farmers' adaptation toward organic vegetable production at 5% level. Therefore, it was apparent that farmers who had high education level could adapt into organic vegetable farming better than those who had low education level.

The positive and significant effects of **experience** on the level of farmers' adaptation toward organic vegetable production at 5% level meant that the adaptation into organic vegetable farming is strongly attribute to the experience of the farmers. This result suggests that as farmer's farming experience increased so did farmer access to information and increased adaptation level and that household heads with relatively higher farming experience took shorter time to assess potential of the

information and skills based on past experiences with new practices. Farming experience and social participation were significantly related to farmer knowledge level about pest management practices in Pambaimadu, Vavuniya District, Sri Lanka (Nagenthirarajah et al., 2008). Farmers who have high experience in organic vegetable farming can adapt into organic ways as well because they can manage their practice in vulnerable circumstance.

The negative and significant effects of **natural water** on the level of farmers' adaptation toward organic vegetable farming meant that in comparison with farmers who received water from groundwater sources and irrigation, these farmers who received water from natural sources were likely to adapt into organic vegetable farming less than the farmers who received water from groundwater sources and irrigation.

The coefficient of **farmers' networks or membership** in organic vegetable production groups had positive sign as well as significant correlation with farmers' adaptation at 5% level while keeping other variables constant. Increased social participation was important for improving farmers' knowledge on proper use of pesticides and its effect on their health and the environment (Nagenthirarajah et al., 2008).

According to the finding on farmers' adaptation, farmers' decisions to adopt organic vegetable farming depend on complex factors. One of the factors is farmers' perception of the characteristics of the new practice in comparison with the existing (old) practice. Other factors which influence farmers' adoption are the conventional (traditional) ones: resource endowments; socio-economic status; demographic characteristics; and access to institutional services (extension, input supply, markets, etc.). The role of farmers' perception in adoption decisions is, however, scarcely studied (Adesina and Baidu-Forson, 1995). Recently, Adesina and Baidu-Forson (1995) and Adesina and Zinnah (1993) have demonstrated the impacts that farmers' perceptions of the characteristics of different varieties (food quality, yield, tillering capacity, etc) have on the adoption of modern sorghum and rice varieties. This is a useful dimension to look for ways of facilitating farmers' gains in perception of the real characteristics of new technologies, and to identify factors that make differences in perception formation among farmers. Awareness of the factors that influence

perceptions would also facilitate the enhancement of the development and transfer of appropriate technologies.

To support collaborative action, there also needs to be a willingness on the behalf of related institutions such as NGO to engage communities to practice in organic vegetable farming. To build social capital, formal institutions need to be committed to working with communities of practice on adaptation research, policy development and program development. It may require formal institutions to facilitate social learning processes which enable multiple groups to share their knowledge of adaptation to organic vegetable farming and to learn from each other.

The analysis on farmers' adjustment confirmed at statistically significant level that the factors of education, experience, water source, and formation of farmers into an interest group had relationship with farmers' adjustment into organic agriculture. Therefore, it is crucial to create greater knowledge and understanding for farmers to transform their production systems toward organic farming. Focus should be placed on those farmers who still depend on agrochemicals by introducing to them the practices used by model or successful organic farmers. This can be done by getting agricultural extension workers to give them advice or by arranging a field visit for them to observe organic farms and learn from successful organic farmers. Once the agrochemical dependent farmers witness the practicality and success of organic agriculture, they will have incentive for and confidence in moving toward organic farming. Both agricultural extension advice and real farm visit methods will enable them to learn the facts and get knowledge that they can apply suitably in their own situations to eventually become organic farmers. On the issue of the expectation about future operation of the organic farmers' group, the group members were of opinion that the group should be enlarged to get more new members but not too large to be manageable. They wish to see the group grow and become strong with self-management ability and perpetual development, and have the well-planned production patterns for each crop growing season. Furthermore, it was indicated that the group still wants to receive supports in terms of knowledge like plant pest and disease management and external financial resource, and wants to put cooperative efforts to foster the growth of the group itself.

4.12 Sustainable development in farmers' livelihood

As an approach to understanding and assisting development the sustainable livelihoods approach contain part of the basic needs approach on organic vegetable farming in the target areas and is a way to improve understanding of the livelihoods of farmers. It can be used in organic planning new development activities and in assessing the contribution that existing activities have made to sustaining livelihoods. The sustainable livelihood provides researchers with a holistic and integrated view and understanding of the components and processes of organic farmers' livelihoods. The aim of this topic was to analyze the sustainable livelihoods approach as a research tool within organic farming. The sustainable livelihood draws together a number of disciplines, providing a holistic approach which researchers can use as the principal frame for research.

An analysis of the capital assets of the adaptation into organic vegetable production systems is the heart of the framework. Capital assets are divided into natural, social, human, physical and financial ones. Farmers under study had demonstrated their adaption to cope with the dynamics of the five capitals including human capital, natural capital, physical capital, social capital and financial capital. In the production of organic vegetables, some farmers had re-oriented their strategy to place greater emphasis on natural resource conservation, consumers' health, and selection of appropriate technologies, in order to deal with the globalized trend, the international trade barriers, and the enormous pressure from the limited capital assets. Consequently, constant adaptation by farmers in the incessantly changing environments becomes crucial for them to be able to survive amidst various pressures and to continue successfully their farming activities.

These can include natural resources, technologies, their skills, knowledge and capacity, their health, access to education, sources of credit, or their networks of social support that can sustain their livelihood especially in organic vegetable production. In overall finding the high degree of sustainability in organic vegetable production were depend on five assets. The details of each asset are following:

1) Human asset

Human asset included the following elements: age of household head, labor, experience and education. According to the study results, Phrao has the youngest of household head at 23 years old, the smallest household size, the lowest educational attainment and the experience in organic vegetable farming.

The average age of household head in Phrao was 45 years old with minimum at 23 and maximum at 65. The age of household heads in Mae Taeng ranged from 25 to 67 years old, with the mean at 51.74. While in Samoeng the average age was 42 years old, with minimum and maximum ages at 36 and 67, repectively.

Education level was classified according to the number of schooling years in this case. In the studied area, most household heads were illiterate. This indicated that there was no significant difference in formal education attainment of household heads observed in Phrao, Mae Taeng and Samoeng.

The majority of farmers in Mae Taeng area had good experience in term of years of farming and years of organic vegetable production for 10 years. This pointed out those households in this studied area planted organic vegetable for a long time in their farming life. Compared with farmers in Phrao that had 1-2 years and these in Samoeng that had 10 years' experience on organic vegetable farming. Thus, it can be generally observed that farmers in these studied areas were interested in growing organic vegetables according to their soil condition.

Organic vegetable production unlike cultivation of other crops, mostly involved non-labor intensive operation. The number of labor used was 1-2 persons from household members. Hired labors were used only especially for land preparation and weeding tasks.

2) Natural asset

Natural asset is the most important asset for rural households because their livelihoods mainly depend on resource-based activities. The soil resource is loam in Mae Taeng and Samoeng, sandy loam in Phrao, respectively. The agricultural land holding sixe is also one of the major natural capitals of farmers.

Water resources are sources of water that are potentially useful for organic vegetable production. Most water resources are irrigation water from local river and also from natural and ground water.

3) Physical asset

Physical assets endowments are the fundamental indicator of households' income and their livelihoods. In soil preparation, farmers ploughed the soil and kept the soil dried for 7 days before growing vegetables as preconditioning for improving soil environment and enhancing vegetable growth. Some farmers applied compost in their plot as a soil amendment to increase the organic matter in the soil. Organic matter is critical for plant development and growth.

Soil fertility in Phrao is fairly good 32%, Mae Taeng and Samoeng is very good 53.4% and 40% respectively. Soil quality is of fundamental importance for agricultural production, and soil fertility management is increasingly becoming a central issue in the decisions on food security, poverty reduction and environment management. In Phraoit has been found the acidifying effect of fertilizers so the farmers should apply organic materials to improve soil physical characteristics.

Land size is one of the reasons for farmers to adapt into organic vegetable farming. Organic farms are located in more diverse landscape types that farmers can manage to cultivate many kinds of vegetable by using rotation.

Organic vegetable is susceptible to attack by various insects and diseases throughout the life cycle and the efficient control of these is inevitable if reasonable yield is expected. Therefore, all organic vegetable farmer respondents in these studied areas used natural pest control methods and products which are safer for their family, less polluting to the environment, and less expensive than toxic, chemical-based alternatives. Natural control methods include the use of predatory insects, yellow trap, light trap, plastic or hay cover plot, net and bio-extract

4) Social asset

The social asset of any community is very important as mutual trusts and connectedness supports to cope with shocks in any vulnerability especially for the poor farmers. Support can be in such form as providing subsidies, giving the technologies of production practices by extension services and shared labor at the time of weeding and harvesting seasons.

Training was evaluated for the training activities in supporting technical knowledge on production such as organic rice production, organic integrated farming, bio-extract, bio-fertilizer, organic vegetable farming, bio-extract, green manure and

social member. Moreover, the extension officer visit can help farmers improve their practice and management in farming systems.

5) Financial asset

With regard to financial asset, farmers' yearly total income and amount of debt received were considered in organic vegetable production system. The farmers' total income was mainly from agriculture and they also used off-farm and non-farm activities for capital. The average yearly income per household was 40,001-60,000 baht per year. The highest level of total income was obtained in Phrao because the cropping system was mainly based on rice and chili and these crops gave higher revenue than the other crops.

Most farmers in Mae Taeng have debt. The reason for this highest incidence of debt was performing of less income according to more interested in organic vegetable production of Mae Taeng compared to other areas and hence capital for inputs in order to increase planted area and more productivity.