CHAPTER 5

FARMER FIELD SCHOOL FOR PESTICIDE-FREE VEGETABLE PRODUCTION

5.1 Farmer field school activity

Farmer field school in vegetable production was different from the original RICE-IPM in Indonesia. Vegetables production is diversified system. Each farmer had his or her own decision in cultivation. The cycle of vegetables run in a short period therefore the relationship between vegetables, pests and natural enemies would change rapidly. Marketing was also important in vegetable production system. Farmers expected to obtain revenue to be worthwhile in their conversion. The limitation in both of ecological and economic aspects caused the vegetables FFS to be differed from the FFS IPM rice, which was monoculture and homogeneous.

The concepts of pesticide-free vegetable FFS were (a) assign the aspects matching with the problem in the area, (b) managing time related to the vegetable growth rate, and (c) emphasis on interactive learning and the researchers as facilitators.

The FFS model was applied to cover integrated crop management (ICM), with the main emphasis on variety selection, soil and nutrient management, and pest management. The content was flexible and could be changed according to the requirement of the farmer participants.

5.1.1 Before FFS: community meeting

Community meeting was conducted on Dec 20, 2002, with the participation of 18 farmers, research team from the Multiple Cropping Center (MCC) and Tambon Agricultural Extension agent who was known as the director of Tambon Service and

Technology Transfer Center (TSTTC). The meeting aimed to explain the objectives of FFS and explore the farmers' vision on their production systems and also on pesticide-free vegetable production.

Farmers envisioned the increasing importance of pesticide-free farming practices in their livelihoods. They had observed the availability of pesticide-free vegetable products in the selected markets and big supermarkets in Chiang Mai. The product always fetched higher price than the normal vegetables.

The vegetables produced at Ban Ping Noi provided more stable income than that of longan. Farmers would like to adopt and include more diverse vegetable species on the rotational basis to reduce pest incidence as they had observed in the many trainings.

The farmers had identified the essential needs in order to fulfill their vision of pesticide-free vegetable production and management. These included advice for production plan and planting design, and experiential learning through FFS approach, maintenance of productivity, and marketing arrangement.

The FFS for pesticide-free vegetable production systems started on December 2002 and run in second crop until the end of April 2003. The MCC and the TSTTC were the facilitators until the end of school.

After the community meeting, thirteen farmers participated in the first production cycle had agreed to start their first planting date on December 25, 2002. The total 10 FFS sessions on every Wednesday began on January 3, 2003 covered two cycles of vegetable production (Table 5.1).

Table 5.1 Farmer field school activity in pesticide-free vegetable production

Week 1 - Field observation - Discussion: vegetable growth - Special topic: *"Soil and nutrient management in acid soil"* - Collecting soil samples from each farmer plot for chemical analysis Week 2 - 1 hour for field observation - Discussion: assessing vegetables growth rate, pests and diseases incidences, nutrient management and problems in production - Sharing experiences among farmers Week 3 - Field observation - Discussion: the disturbance of vegetable pests, vegetable flea beetle controls - Special topic: *"Pest management: relationship between pests and enemies in pesticide-free vegetable production"* Week 4 - Field observation for one and half hour - Discussion: Type of vegetable diseases, causes and solutions Week 5 - Field observation - Discussion: The experience from participating in Mae Jo Fair at Mae Jo University and Pesticide-free Vegetable Fair at MCC station, and marketing of pesticide-free vegetable - Farmer experiment on spinach variety	Week 6 - Field observation - Discussion: marketing and planning for second crop production Week 7 - Field observation - Discussion: types of vegetable harvested in the first crop and yield, monitoring demonstration plot, monitoring spinach variety trials, planning for the second crop production Week 8 - Field observation - Discussion: evaluation FFS activity in first 2 months, cost and benefit calculation - Special topic: *"planning for the second crop"* Week 9 - Field observation - Discussion: estimation of harvesting date and yield in the second crop Week 10 - Field observation - Discussion: new trader agent "Tarn Kaset", learning from FFS activity, the follow-up activity

5.1.2 Farmer field school session

First session

On the first day of FFS, January 3, 2003, farmers were briefed on soil testing and interpretation of chemical analysis regarding soil chemical properties and nutrient status by the teaching staff of Department of Soil Science and Conservation, Faculty of Agriculture, Chiang Mai University. A modified soil test kit developed by the Department was also being introduced. Farmers became aware of their soils having low pH, averaging below 5. So farmers occasionally applied lime to correct for suitable pH for vegetable production.

Farmers had also learnt about the importance of trace elements when they produced vegetables for one Japanese firm on contract. The company helped analyze the soil and found that it was deficient in boron. Farmers learnt that a few common species of vegetables, such as cauliflower, cucumber, and chili pepper were sensitive to boron deficiency. The company helped them to get access to chemical fertilizers which were not easily obtained from the local market. So farmers had avoided planting vegetable species that are susceptible to boron deficiency.

Second FFS session: January 8, 2003

There was no evidence of disease in the field but a few pests were found. Farmer identified flea beetles and diamond black moth as the important pests in the area. Cruciferous vegetables, such as Pak Choi, cabbage, and Chinese kale, were vulnerable especially in areas with year-round production.. The critical time was 7 to 14 days after planting particularly on April and November. Farmers indicated that flooding in this year had reduced the spreading of flea beetles and it was less than a few years ago. Neem extract was not effective in regulating flea beetle population. Sticky trap was also applied to reduce pest population, but the method was found to be not effective. . The farmers were introduced to paint board or plastic sheet with the sticky glue and drag over the field plot. This method was suitable for a small plot. For diamond black moth, catching adults with net or picking larvae in the plot were introduced. Biological control with natural enemies, Hermiptera order, was one alternative for farmers.

Third FFS session: January 15, 2003

The officer from Institute of Biological Agriculture and Farmer Field School (IBAFFS) had helped review for the farmers with knowledge in pest management, natural enemies and biological control measures. Flea beetles and aphids were found in this week. A trial of sweeping the plastic sheet, painted with sticky glue, across one plot of Pak-Choi and counted the number of flea beetles found that the density of insects on plastic sheet was 14 per sq. inch. The number of aphids also counted from the sampling leaves, the average density of aphids was 36 per sq. inch. Under this circumstance, farmers perceived that crop rotation and sticky trap were not effective in case of planting monoculture all-year-round in a large area. The pest population would be decreased by the diversified crop rotation together with the use of yellow or sticky traps.

Forth FFS session: January 22, 2003

The farmers could not carry on planning due to raining at the end of December until early January. Only 8 farmers remained in the production process.

Continued soil wetting and poor drainage had caused root rot in spinach at the young stage (5 – 7 days after germination) and water spinach was also damaged by fungal disease.

Fifth FFS session: February 5, 2003

Farmers encountered with the problem in seed germination in spinach and water spinach. Farmers were not certain the real cause of poor germination, whether it was due to poor seed quality or their own management practices. But eventually, when farmers compared vegetable growth across plots, they concluded that it was due to poor seed quality. Pak-Choi and Chinese kale were still damaged by flea beetles. Thrips and ants were found to be new pests for spinach at this time.

When the first harvest was carried out, the subject was directed towards marketing strategies and distribution outlets. The farmers had participated in setting up a stall in Mae Jo Fair (established by Mae Jo university) and First Annual Safe-Agriculture Safe-Life Fair organized by the MCC, Chiang Mai University. Group discussion about the experience from the fairs pointed to variety of vegetables, pricing

and consumer preferences. More than 50% of vegetable farmers included local vegetable species for sale in the Fairs. Marketing in the initial stage was managed by group representatives. Pricing was set at the same price with the MCC store, which was higher than the conventional price by about 3 times for Pak Choi. Farmers and research team also discussed about alternative marketing channels. These included mobile units within the University campus, governmental offices in Chiang Mai city, participating in the monthly marker fair, and placing at the MCC shop. A 20 percent commission would be provided to students who involved in distributing the products in various places.

Sixth FFS session: February 12, 2003

Farmers evaluated potential and yields in the first crop. Table 5.2 displays the potential of each variety in Ban Ping Noi. The quality of cruciferous vegetables; Pak Choi, Hong Te and Chinese kale were lower than the conventional distinctly due to the damage caused by flea beetles. Over production became a problem, as the product was not accepted by the conventional market due to less appealing physically. Farmers were suggested to control their production by reducing plot and increasing species diversity in their field for minimizing risk.

Table 5.2 Potential of vegetable species in the first crop in Ban Ping Noi, 2003

Vegetable species	Potential
Water spinach	Less pest and disease disturbances except in case of inappropriate management such as over fertilizing or watering
Hong Te	Susceptible to flea beetles during the young stage
Chinese kale	Long maturity (45 days), low germination and susceptible to flea beetles
Spinach	Nonproductive if planting after mid February
Pak-Choi	Susceptible to flea beetles but the damage was less than other Cruciferous vegetables
Raphanus sp.	Long season vegetable, damaged by flea beetles, low price and less market demand at present time

Source: survey, 2003.

Seventh FFS session: February 19, 2003

Due to low capacity in PFV marketing, farmers were willing to allocate their products to the conventional market at the conventional price Determined by the traders.

Some farmers were gone through the second crop. In this crop, farmers had increased diversity in their fields in one case, a farmer had planted with 21 varieties of varying maturity range: (a) short season variety (30 to 45 days) such as water spinach, *Chrysanthemum* sp., spinach, Pak Choi, Chinese Amaranth, coriander, lettuce and Chinese kale, (b) semi-long maturity with the range of harvesting date around 45 to 60 days (e.g. Chinese cabbage, yard long bean, brush bean and shallot), (c) long maturity for instance of pepper angle loofa, cauliflower, cucumber, sweet corn and chili that harvesting day is over 60 days after planting and (d) local vegetable like Pak Plang and local coriander. Farmers were arranged to select one main variety produced as PFV and planted at 5 to 7 day intervals continuously in the whole month. Minor variety was allowanced to planted in case of not repeated with another.

In this planning, farmers were specialized in each variety and sharing knowledge with the beginner. Farmers indicated that it was easy to trace back to the producer if chemicals residues were found. This method was also reducing the competition among members.

Eighth FFS session: February 26, 2003

Seven farmers, who had completed the first crop, evaluated their satisfaction on PFV production. Income from PFV production was compared with the opportunity cost in conversion. The study found that three of them had the income increased by 10 to 20 %, two farmers obtained lower income by 10 to 20%, and the remaining two did not see the income difference between PFV and the conventional.

There were eight farmers participated in the second crop whilst some members were still planting the first crop. Local traders were invited to provide information on marketing perspective, consumer preference, wholesale prices, and advice on vegetables with market potential. The risk on production and marketing of each variety were displayed in Table 5.3.

Ninth FFS session: March 5, 2003

The second crop was started in the early of March. Farmers had withdrawn planting of Cruciferous vegetable due to heavy infestation of flea beetles. Lettuce, shallot, Chinese amaranth, coriander, water spinach, Chinese kale and angel loofa were selected. In this round, there was not restricted on planted area. The surplus was sent to the conventional market.

Farmers had shared the market of MCC at the Maharajh Hospital and expended to District Administration Office at Hang Dong. One member invested to set up a stall for PFV at Lumphun Jatujak Market.

Tenth FFS session: March 26, 2003

Hot climate would not favor the production of leafy vegetable, except for the coriander, sweet corn and cucumber

Before finishing the FFS, farmers had discussed what they had learned from FFS. FFS encouraged them to recognize the diversity of agro-ecosystem that related to the relationship of pests and diseases incidences. Learning-by-doing through the field experiment generated the new knowledge. Participating in marketing helped farmers improve their strategies relevant to consumer preference.

Table 5.3 The risk on production and marketing of vegetables as perceived by local trader

Vegetable variety	Risk on production	Price	Market demand	Planting method
Water spinach	1	Moderate	High	Broadcasting
Chinese amaranth	1	Moderate	Low	Broadcasting
Corainder	1	High	High	Broadcasting
Lettuce	1	Moderate	Moderate	Broadcasting
Shallot	1	High	High	Transplanting
Pak Choi	5	High	High	Broadcasting
Sweet corn	2	High	High	Transplanting
Chinese kale	5	Moderate	High	Broadcasting
Angel loofa	1	High	High	Transplanting
Brush bean	2	No information	Low	Transplanting
Cauliflower	3	Moderate	High	Transplanting
Pak Plang	1	Moderate	High	Transplanting
Basil	1	High	High	Transplanting
Mint	1	Moderate	High	Transplanting
Chrysanthemum sp.	5	Moderate	Low	Broadcasting

Source: Meeting on February 26, 2003.

Note: 1 denotes lowest risk and 5 donates highest risk

5.2 After FFS

Only one farmer had completely changed from monoculture to diversified system with more than ten species spreading over one growing season. All species were marketable. A few farmers only concentrated on less than three species at one planting time. One farmer changed cropping sequence, but continued to practice monoculture. which could be harvested in large quantity at one time to satisfy the trader's demand. The farmer preferred the lump sum of cash from big seasonal harvest rather than daily small income. Farmers who were keen on rotational cropping of single or a few species preferred safe-use of pesticides rather than complete avoidance. A few farmers pointed out that the practice of pesticide-free vegetable production was less feasible when the neighboring farmers continued to spray chemicals for pest control. However, the farmer who planted with diverse species and adopted integrated management practices was able to achieve productive output despite the heavy spraying from the neighboring farmers.

Farmers saw the effectiveness of using sticky, yellow traps either distributed over or sweeping across the production field as mechanical means for pest management.

5.3 Farmers' learning through farmer field school approach

5.3.1 Farmer participatory in learning activities

In the first FFS meeting, goals for pesticide-free vegetable production were established. It included reducing chemical application and production costs, marketing arrangement and producing in all-year-round production.

To reduce the chemical application, compost fertilizers and natural substances, i.e. neem extract and bio-extract from the residues in their field, were integrated with the fertilizers and chemicals in the first stage of transition.

With the respect to reducing production costs, diversity of vegetables, reducing of external inputs and reducing seed density were recognized. Farmers would like to diversify their production but they concerned on the uncertain marketing of new products. External inputs such as chemicals and fertilizers could be replace by the residue in field or the materials in the community. Farmer was over seeding on

their production like an in case of Pak Choi production, they preferred to thinning after 15 days of transplanting because of the uncertainty of seed germination, and the cost of seed is not expensive, the over seeding did not increase in their cost too much and make they ensure to the productivity.

For the marketing arrangement, farmers had negotiated with the externals such as local traders and government extension agencies and participated in marketing to develop their skills that leading to be liberated from the local traders.

Farmer intended to produce pesticide-free vegetable continually all year round that the chance to extend or decrease in planted area and diversity on production were depend on only marketing that mean price and volume of products could be distributed. To achieve this goal, farmers was planning together among the members before planting for reducing risk in production including sharing their knowledge and experiences.

Farmer participatory planning

In the first crop, the participatory planning design was based on the following principles: use of biodiversity to offset biological and price risks, supply meets demand, compatibility with household resources, and equal access and sharing of benefits.

Six short-seasoned vegetable species with maturity ranged from 32 to 45 days were identified, there were listed as followed: Flowering Pak-Choi (Brassica campestris var. *chinensis*), water spinach (*Ipompea aquatica*), Chinese amaranths (*Amaranthus dubius*), Hong Te (*Bassica campestris* L.var. *chinensis Bailey*), spinach (*Spinacia oleracea* var. *inermis*) and Chinese kale (*Brassica alboglaba*).

The farmers would be divided into 6 sub-groups with 2 or 3 members each. Each member would allocate about 800 sq.m. to plant 6 species of vegetables. There were two planting designs proposed in the meeting.

1. Each species would be planted at 5-day intervals. When the first harvest began in early February 2003, each sub-group would produce 320 to 400 kg. of each species during the 5-day period of continued harvesting. There would be a total 2.4 ton of vegetables to be distributed

2. Each member divided 800 sq.m. into 6 equal parcels. Each parcel had 133 sq.m. and 6 species were equally allocated and would be planted at the same time. Each parcel would be planted to 6 species at 5-day intervals.

At a given time, the Design 1 was less diverse, while in the Design 2, all farmers would have similar diversified system consisting of 6 species. The Design 1 seemed to face higher ecological and price risk than the Design 2. However, majority of the members selected the Design 1, since it produced the quantity of vegetables large enough for the wholesale shipment despite all the higher risk involved.

They have changed Chinese Amaranth species to be local vegetable "*Raphanus sativus* L." as there was less disturbances of pests and diseases in this specie compared with Chinese Amaranth which was new species in this area, it had production and marketing uncertainties.

For the second crop planning, local trader had participated in providing information on marketing perspective, consumer preference, wholesale prices, and advice on vegetables with market potential. Eight farmers decided to produce one main variety as PFV, which was low risk on production, easy management, appropriate price and meeting to market demand. Pak Choi, Chinese kale, water spinach, Chinese amaranth, coriander, shallot, brush bean, sweet corn, chili, angle loofa, cauliflower and local vegetable "Pak Plang" were selected. Eight varieties were selected to be the major crops such as water spinach, Pak Choi. Chinese kale, Chinese amaranth, lettuce, shallot, angle loofa, and coriander. Chinese amaranth, which was rejected in the first crop, was selected in this round due to the confirmation of local trader in marketing demand.

It was noticeably that in the first crop most vegetables were leafy vegetables, with which farmers were familiar. But in the second crop, the farmers tended to select long maturity varieties and had more fruit types. The reason was from the infestation of flea beetles in the field plot leading to farmers' recognition that crop rotation and biodiversity could reduce pest and disease incidence.

Farmer experimentation

Farmers had their own field experiment that consistent to their needs. Since the new varieties were selected in the first crop, farmers had tried out different management such as land preparation, broadcasting method, mulching material and different sources of seed. Learning by doing leading the best management that was suitable for each farmer.

Spinach, new variety with the incentive from high price about 50 baht per kg., was the challenge for the farmers. Many trials on broadcasting, mulching and seed source were examined. The result indicated that row planting of spinach performed better than broadcasting method with the average yield of 2.65 and 0.30 kg. per sq.m., respectively. Mulching with rice husks or rice straw reduced seed germination in case of land preparation was not well done that offered to the dropping of seeds into the gap between soil particles. Three farmers examined spinach seed from five sources, the result indicated that three of them were not effective while the imported seed from Netherlands and China had the 50 percent of germination.

Field experiment was conducted on February 8, 2003. Thirteen of marketable varieties comprised with Coriander, *Chrysanthemum* sp., Chinese cabbage, Chinese amaranth, lettuce, shallot, Chinese kale, spinach, ankle loofa, Japanese cucumber, brush bean, sweet corn and water spinach, were examined on their productive. The result was shown in Table 5.4.

Table 5.4 The productivity of vegetables in the farmer experimentation.

Vegetable variety	Harvesting date (days)	Yield/area (kg/sq.m)
Chinese amaranth	28	7.91
Chinese cabbage	26	3.39
Chinese kale	25	4.88
Lettuce	30	0.83
Spinach	60	2.33
Water spinach	20	2.50
Coriander	44	1.38
Chrysanthemum sp.	-	-
Brush bean	40	0.50
Angel loofa	41	7.18
Japanese cucumber	37	2.88
Sweet corn	80	0.38
Shallot	110	1.21

Source: Survey, 2003.

Typically, leafy vegetables were not planted in January until April, to avoid from flea beetles infestation and the stunt growth due to hot climate. Farmer encountered with seed germination caused by low quality of seed and inappropriate seedbed management. Chinese amaranth was the best productive variety with the yield of 7.91 kg per sq.m that caused by highly seed rate utilization. Chinese cabbage and Chinese kale were good productive even though disturbed from flea beetles with the 3.39 and 4.88 kg per sq.m yield. Lettuce was also good productive and less disturbed from pests, farmers indicated that its taste was bitter that the insect pests dislike. Spinach was planted under shading. It was good productive although the weather was quite warm. Over fertilizing in the second weeks caused the death of seedling that made the yield drop into only 2.33 kg per sq.m. Water spinach in warm

weather had grown faster than the winter. Coriander and *Chrysanthemum* sp. were susceptible to burning from the sunlight in hot season, planting without shading produced only 1.38 kg per sq.m of coriander when the Chrysanthemum was not productive. Brush bean had the best of germination rate with 100%. Farmer planted in the line spacing of 30 × 60 cm. Its yield was only 0.50 kg per sq.m caused by planting without stalk holding. Some yields were rot from touching soil surface. This variety was not impressive to farmers, they stated that its light weight was not worthy with the intensive management. Angel loofa germinated in only 15% but produced 7.18 kg per sq.m The spacing was 50 × 100 cm. That mean it produced about 13.5 kg per plant. Japanese cucumber had highly variance in seed germination with range from non-germinating until to 71.4%. The average germination rate was 39%. Sweet corn was disturbed from Corn Earworm (*Helicoverpa armigera*) that produced only 0.38 kg per sq.m. For shallot, hot climate activated to the reproductive stage while the vegetative stage was not complete

Production and Yields

When the first crop was harvested, 5 of 6 varieties were productive as shown in Table 5.5. *Raphanus* sp. was not harvest in the first crop because of it was long maturity vegetables. The harvesting day was over 60 days. According to yield table, Chinese kale seemed to the most effective than another variety with the average yield was 4.49 kg per sq.m and Hong Te was the less effective variety with the 0.68 kg per sq.m of average yield. Actually, in the first crop, Cruciferous varieties were severely damaged from flea beetles due to the migration of them to escape from the spraying in conventional plot next to the pesticide-free field. The warm climate on January until to the late of February was suitable for Spinach that produced average yield of 2.06 kg per sq.m. Water spinach was the one variety that less disturbance from pests and diseases only if in case of inappropriate management such as over fertilizing or watering with the average yield was 1.76 kg per sq.m. Table 5.5 displays the range and average yield produced in the first crop.

Table 5.5 Yield in the first crop

Variety	Yield (kg / sq.m)	
	Range	Average yield
Spinach	0.3 – 4.0	2.06
Pak Choi	2.5 – 3.0	2.75
Chinese kale	0.35 – 12.5	4.49
Hong te	0.35 – 1.0	0.68
Water spinach	0.58 – 2.29	1.76
Raphanus sp.	-	-

Source: Survey, 2003.

In the second crop, only one variety of angle loofa was distributed as PFV with the yield was 7.20 kg per sq.m. The harvest started at 41 days that was totally 19 times, the average yield per time was 8.50 kg. Shallot was infected from fungi disease in the second month, farmer decided to spray fungicide for going on production and intended to distribute his product to conventional market. Finally, the shallot was not sell, the farmer kept them to produce the seedling for the next crop with the yield was 0.68 kg per sq.m. Pak Choi and Chinese kale were damaged from flea beetles. They were low quality that could not distribute in both the conventional and the pesticide-free market. Water spinach and Chinese amaranth were good productive at that time, unfortunately there was low marketing demand comprised with the over production, the products were left in the field and ploughed under when they prepared land for the next crop. For the coriander, hot climate was not suitable for planting in the open-field without shading. The vegetables was stunted, their leaves turned to yellowish easily and infected with wilt disease. However, it was productive at 0.64 kg per sq.m. The productivity and yield in each variety of second crop were shown in Table 5.6.

Table 5.6 Productivity and production constraints of vegetable in the second planting (March – June, 2003).

Variety	Yield (kg / sq.m.)	Potential
Shallot	0.68	Susceptible for fungi decease
Pak Choi	-	Damaged from flea beetles
Chinese Amaranth	-	Over production with low market demand
Coriander	0.64	Not suitable for planted without shading
Water spinach	-	Over production with low market demand
Chinese kale	-	Damaged from flea beetles
Angle loofa	7.20	Susceptible for Downey mildew and aphids

Source: Survey, 2003.

5.3.2 Farmers' adaptation on pesticide-free vegetable production

Farmers had adapted themselves all the time of learning in four months that caused to the changing in their system as follows.

Farmers' adaptation on production

Farmer recognized the significance of the diversity of varieties that helped distribute the risk on production and reduced pest and disease incidence in their field. Their had paid more attention on land preparation, large planted area was replaced by the raising bed, organic manures from cow, pig and chicken were added to the field to improve soil quality and to reduce the use of chemicals fertilizer. Farmers had developed their own planting method for cultivation. Pest and disease management also changed into more kindly with environment. In the past, spraying was done for preventing from pests or disease. After they realized on the relationship of insect pests and natural enemies, the application of natural substances such as neem extract, and bio-extract were increased. And consequently the number of spraying in conventional plot was decreased.

Farmers' adaptation to marketing

Market channel of pesticide-free vegetable was gone through many phases. The distribution of pesticide-free vegetables were gone together with local vegetable in community. Figure 5.1 displays the present market channel of pesticide-free vegetable of Ban Ping Noi.

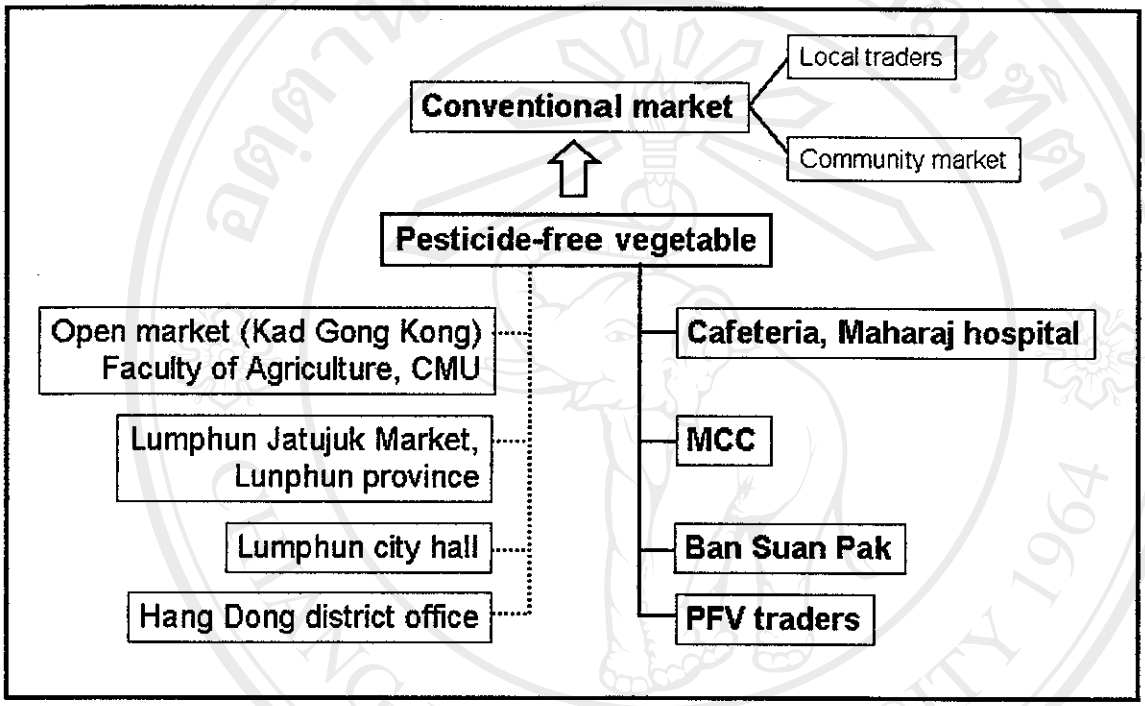

Figure 5.1 Market channel of pesticide-free vegetable of Ban Ping Noi

5.4 Organization Supporting Farmers' Learning

Farmer Field School in this study collaborated with many organizations that encouraged farmers' knowledge and facilitated in the process like shown in Table 5.7.

Table 5.7 Organization encouraging in farmers' Learning through FFS approach

Organization	Activity
Multiple Cropping Center	Facilitators
Saraphi District Agricultural Extension Office	Public relation
San Sai sub-district, Tambon Service and Technology Transfer	Training, field trip and searching for seed source
Department of Soil Science and Conservation, Faculty of Agriculture, Chiang Mai University	Lecturing in nutrient management
Department of Plant Pathology, Faculty of Agriculture, Chiang Mai University	Lecturing in disease management
Institute for Biological Agriculture and Farmer Field Schools (IBAFFS)	Lecturing in pest management and the relationship between insect pests and natural enemies
Plant Protection Unit, Chiang Mai	Instruction on the use microorganisms; *Bacillus thuringinensis* sp. in pest control

Source: Survey, 2003.