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Report on Fieldwork for ‘Sustainable Flowers in Vietnam’, 18 September- 2 October 2006

Contents

Summary

This report describes the results of fieldwork done by Dutch and Vietnamese experts on the Vietnamese rose sector, specifically in the Me Linh and Sapa region. This field work was done during the period September 16 and October 2, 2006. The main objective of the field work was to investigate institutional arrangements that enable active participation of rose farmers, government agencies and flower companies in enhancing sustainability performance in the Vietnamese flower sector. Hands on insights in the current field practices in the Vietnamese flower sector and policy oriented awareness activities pesticide regulation, is used to complement the investigation.

In Vietnam the poverty as a whole has declined in the last decade. However, the rate of decline and incidence of poverty varies greatly across regions. The largest difference is between rural and urban areas. Poverty also has a clear spatial and ethnic dimension, with the Central Highlands and the Northern Mountains having poverty incidence rates that are twice as high as the national figure. These differences provide a large incidence for rural households to migrate to urban areas. This results in high urbanization growth rates. To turn the tide, increasing agriculture income for the 62 million people living in rural areas, is a key priority to the Vietnamese government. The Vietnamese Ministry of Agriculture and Rural Development (MARD) has designed a number of development programs in order to improve the sustainability of the agricultural sector. These programs stimulate agriculture research on technology development and extension work for the poor, crop diversification, export commodity development programs and stimulating market structures and trade promotion programs. For this, one of the specific aims is to decrease pesticide use with 20%, as pesticide use is seen as one of the biggest threats to health, environment and export possibilities.

The Vietnamese floriculture sector is growing fast and is expected to be able to make a substantial contribution to an increase of income for the rural population in specific regions, including farmers in cooler higher altitude areas such as the Central Highlands and Northern Mountains. So far the flower sector development has been almost exclusively developed throughout private sector involvement, mostly innovative small farmers. Almost all flower production is destined for the domestic market (van Wijk et al., 2005; Allbritton et al, 2005).

Roses, planted for a period of approximately 7 years, are considered a “preferred crop” because they need less handling work than vegetables, and bring up 5-7 times as much as rice and 3-4 times as much as vegetables. However, roses require more pesticide input (about 3-5 times more pesticides than vegetables), and consequently the amount of work and the costs related to spraying are relatively high. Hence, the level of pesticides use appears to be very high in the sector, causing a negative effect on the environment, the health of the growers and the surrounding community, and also the economic performance of the rose farms (van Wijk et al., 2005). A risk of the intensive use of pesticides is the accumulation of pesticides in surface and groundwater, which in many areas is the main

drinking water source. Also, farmers seem to have a lack of knowledge on safe application methods, which might result in health problems. Finally, inefficient pesticides use might result more elevated production costs than necessary and a possible negative impact on the quality of the final produce offered to the market.

The fieldwork shows that flower producers seem to experiment with different flower varieties and chemical input applications, and these experiments are mostly based on trial and error. Regarding learning for innovation, the producers obtain information about new technological and cultivation practices from a variety of actors. The most important source is neighbouring farmers or rose farmers in other regions, and shopkeepers selling pesticides. In some cases, also information is obtained from local officials at the plant protection department (PPD). This organisation also issues certificates to the pesticide shop owners, and control regularly their performance by surprise inspections. Representatives of pest control producing companies introduce new products developed in other regions of the world and inform the producers through meetings on the adequate use of these products. At the level of regulation, the Vietnamese government is responsible for tasks such as regulation on the use of pesticides, regulation on the production of pesticides, labelling of products (pesticides), and registration of pesticides. Nevertheless, participatory fieldwork revealed that the solutions applied by these small rose producers to solve pest and disease problems were mostly aggregated solutions from earlier experiences with food crop production. Parts of these practices are not considered to be accurate for flower cultivation.

Technological innovation comes down to adequate selection and adaptation of existing technological packages. The weak vertical linkages of flower producers with public and private research and development organizations can be considered a hindrance in tailoring more disruptive innovation of cultivation practices and the technology solutions used to reach environmentally friendly production methods that apply to the specific conditions in flower producing regions. As with regards to the Vietnamese rose sector, distribution, certification and registration of pesticides importantly constitute vertical interactions between flower producers and other actors. However, at the level of technological innovation, problem solving and incremental technological changes, establishing sustainability in the Vietnamese floricultural sector may benefit from inputs in the sphere of promoting interactions and feed back between flower producers and knowledge generation in public research institutes as well as in private research laboratories. For example, the creation of a diagnose service in the production can help the producers in the determination of new, unknown or less commonly occurring diseases and to choose the right fighting method: physical control (plant removal), chemical control, instead of recurring to the trial and error method. For this reason, the introduction of technological innovation in the rose cultivation practices in this case will have to be accompanied by adjustments in the institutional framework, for the producers to be able to establish (stronger) linkages with flower experts so they will obtain new knowledge that will not be found using the current learning practices. In the report results are presented on the current cultivation and plant health practices used (Chapter 5) as well as the current pest control mechanism applied (Chapter 6). Due to the focus on sustainable development, a brief description is presented on the current market trends and constraints (Chapter 7). In order to be able to respond in an effective way to these market trends, learning processes and innovation are of utmost importance. For this, information is presented on information

collection, knowledge building and sharing and learning processes (Chapter 8). Based on these results, the report concludes with the presentation of a number of key observations and recommendations to be considered in order to help the sector to improve its sustainable development.

1. Introduction

Although poverty as a whole has declined in Vietnam in the last decade, the rate of decline and incidence of poverty varies greatly across regions. The largest difference is between rural and urban areas. Poverty also has a clear spatial and ethnic dimension, with the Central Highlands and the Northern Mountains having poverty incidence rates that are twice as high as the national figure. These differences provide a large incidence for rural households to migrate to urban areas. This results in high urbanization growth rates. To turn the tide, increasing agriculture income for the 62 million people living in rural areas, is a key priority to the Vietnamese government.

To achieve the goal of decreasing rural poverty through increasing agricultural income, being a strategy linked to the Millennium Development Goals, 13 programs are designed in the strategic five year plan (2006-2010) of the Vietnamese Ministry of Agriculture and Rural Development (MARD). The most important programs are focused on agriculture research on technology development and extension work for the poor, crop diversification, export commodity development programs and stimulating market structures and trade promotion programs. One of the mayor goals of the program is to improve the sustainability of the agricultural sector. For this, one of the specific aims is to decrease pesticide use with 20%, as pesticide use is seen as one of the biggest threats to health, environment and export possibilities.

The Vietnamese floriculture sector is growing fast and is expected to be able to make a substantial contribution to an increase of income for the rural population, especially for ethnic minorities in cooler higher altitude areas such as the Central Highlands and Northern Mountains. The labor intensive nature of flower production and high returns per hectare make it an interesting commodity to stimulate rural development in these areas and to reduce poverty.

So far the flower sector development has been almost exclusively developed throughout private sector involvement, mostly innovative small farmers. Almost all flower production is destined for the domestic market. An estimated 285 million roses are supplied to costumers in Hanoi per year, which generates income for an estimated 12610 people with a gross value of US$25 million (Quang, D., 2005). The emergence of a variety of market channels in Vietnam, partly driven by the rise of modern distribution formats (such as supermarkets, hypermarkets, warehouse clubs and convenience stores) offer a largely uncharted terrain for the sector. Also, new opportunities might be available in nearby Asian markets.

This report describes the fieldwork done in the rose sector of the Me Linh and Sapa region. This fieldwork was done by Dutch and Vietnamese experts in the period September 16- October 2, 2006. Chapter 2, 3 and 4 describe the problem definition, research objective and research limitations of the fieldwork. In chapter 5 and 6 together information is presented regarding the first research objective. In chapter 5 focuses on the description of the current cultivation methods applied and plant health situation in each of the two

regions. Chapter 6 focuses on the current pesticide control mechanisms used. Chapter 7 presents information on market access and market constraints. After this, Chapter 8 describes the results obtained to answer the second research objective. In this chapter information is presented on practices used to collect information, knowledge building and learning on sustainable rose production. The report is finished with the presentation of observations and recommendations in Chapter 9.

2. Problem definition

The first analysis made on the development of the floriculture sector being part of the ProPoor program (project report PR-V03), indicated a possible negative effect of pesticides use on the sustainable development of the sector.

Incidence of pesticides use seems to be very high in the sector, causing a negative effect on the environment, the health of the growers and the surrounding community, and also the economic performance of the rose farms (Quang et.al., 2005). The dominant attitude seems to be that more pesticides can be used in flower cultivation than fruit and vegetable production, since flowers are not consumed by people.

A risk of these practices is the accumulation of pesticides in surface and groundwater, which in many areas is the main drinking water source. Moreover, many farmers raise and consume fish in surface water. Also, farmers seem to have a lack of knowledge on safe application methods, which might result in health problems. Finally, inefficient pesticides use might result more elevated production costs than necessary and a possible negative impact on the quality of the final produce offered to the market. However, little research and extension is done on analyzing current rose cultivation practices in Vietnam and the opportunities to develop more sustainable production methods (Van Wijck et.al, 2005). Farmers seem to experiment with different flower varieties and chemical input applications, and these experiments are mostly based on trial and error.

In 2006, Wageningen University from The Netherlands, Fresh Studio Innovations Asia from Vietnam and The Vietnamese Agricultural Ministry (MARD) initiated an explorative research, to investigate and build institutional arrangements that enable the active participation of rose growers, government agencies and flower companies in enhancing sustainable performance in the Vietnamese flower sector.

As part of this initiative, fieldwork was done during the period September 16 and October 2, 2006. The aim of this field work was to obtain more data on the current pesticide use in rose cultivation and its implication on the sustainable development of the sector.

3. Research objective

The main objective of the field work was to investigate institutional arrangements that enable active participation of rose farmers, government agencies and flower companies in enhancing sustainability performance in the Vietnamese flower sector. Hands on insights in the current field practices in the Vietnamese flower sector and policy oriented awareness activities pesticide regulation, is used to complement the investigation.

3.1 Research questions

The two research questions of the field work were:

1. what rose cultivating practices do Vietnamese rose farmers use currently, and what are the technical aspects of pest and disease management and effects of pesticide use on product quality, environment, health and market access;
2. what information gathering methods do Vietnamese rose growers use on rose production in general and pest and disease management specifically, and how do they use this information for learning and process innovation.

3.2 Research design

As part of the preparation of the stakeholder dialogue, a team of three experts of Wageningen University visited Vietnam from September 16 to October 2, 2006. Together with three specialists of the Vietnamese Fresh Studio and two specialist of the Vietnamese Research Center AGI they created an interdisciplinary and multicultural team and worked together on data collecting throughout field work. This report presents the results obtained during this field work.

From April until September a multidisciplinary team of experts from LEI, Alterra, WI and PPO held several meetings to discuss the preparatory activities and the methodology to be used for the field work. Based on these meetings, a working schedule was defined (see attachment 1). This schedule was shared with the Vietnamese counterparts Fresh Studio and AGI in order to double check the feasibility of the working plan and working methods proposed.

In order to enable the feasibility and quality of the work to be done, it was agreed that:

1. The team would make optimal use of work already done. The Pro Poor Horticulture project,[1] a DFID funded project carried out by LEI experts and partners in Uganda

[1] See for more information www.growoutofpoverty.nl.

and Vietnam, was focused on rose cultivation in Vietnam. The results of this project were taken as a starting point.

2. Following the results of the Pro Poor Horticulture Project the rose production areas in Sapa and Me Linh were selected for in depth field work.
3. The fieldwork would consist of expert observations in the field combined with consultations of a wide range of players in the fields of information and pest and disease management, including growers, governmental workers, and representatives of the pesticide trade sector.
4. For data collection, methods applied would be, amongst others, semi-structured interviews, participatory methods, transect walks, Venn diagram.
5. During the visit to Sapa results of the field work in Me Linh were presented to key actors of the Sapa rose sector, such as the manager of a big rose farm, a representative of one of the cooperatives and representatives of the local government involved in the agricultural sector. These actors were requested to indicate the most important differences between the results obtained in Me Linh and their own working and learning methods on pesticide use.

Regarding the methodology, the following agreements were defined:

Team composition:

1. For the fieldwork 2 teams were created.
    1. Learning and innovation and market development team (Myrtille Danse c.s.)
    2. Production methods and pesticide use (Nieves Garcia and Floor Peeters)
2. The fieldwork would be done by 3 WUR specialists: rose cultivation specialist (Nieves Garcia/ PPO), pesticide and environment specialist (Floor Peeters/ Alterra), and a specialist in sustainable supply chain development and market access (Myrtille Danse/ LEI).
3. Three local experts from Fresh Studio were assigned to support the team on the application of participatory research methods to small scale farmers in Vietnam.
4. Also, two local experts on Vietnamese horticulture activities from the research center AGI would support the team intensively before and during their visit organizing the meetings and field visits, and providing feed back on the results obtained.

Area of analysis

5. Two rose production areas were to be visited. Me Linh is closely located to Hanoi and specialized in flowers/roses. It is characterized by many growers close to each other. In Sapa flower production initiated more recently. There is 1 large company and several small scale farmers partly organized in cooperatives, scattered over the region. Fieldwork would take place in both areas, with emphasis on Me Linh and shorter fieldwork in Sapa to compare the 2 areas.

Working method

6. Due to the planned stakeholder dialogue shortly after the field work, the team decided to produce a draft report by the end of the 2 weeks field work. In order to

make this possible, it was decided to plan fieldwork and data collection meetings in the morning, and writing sessions in the afternoon.

7. In the morning the discussions would be in Vietnamese accompanied by partial English translation. One of the Vietnamese researchers would take care of the reporting. In the afternoon each team (Vietnamese facilitator, Vietnamese expert, translator and the Dutch expert) would make a report in English. At the end of the afternoon/evening this information was used to plan the next day field work. After one week, the results were used to analyze the development of the field work, and plan the remaining work to be done.
8. Week 1: fieldwork in Me Linh, 30 minutes drive from Hanoi, during this week the team would stay overnight in Hanoi. Week 2: 3 days of work in Sapa and 2 days of work in Hanoi.

4. Research limitations/ constraints

1. Due to limited funds available for the field visit, only limited time could be dedicated to preparatory desk research on the identification of pest and diseases and the use of pesticides in the Me Linh region, followed by two weeks of field work.
2. Due to the short time available for the field work, the data collection could not take place based on a high number with a big sample of individual growers and other stakeholders involved. In order to obtain a general but representative impression on the diversity of working practices, but also to discover certain patterns, it was decided to collect part of the data by facilitating group discussions.
3. Since the experts from Wageningen did not speak Vietnamese, each team had to work with one translator, translating the least information necessary for the experts to understand the content of the meetings with the different stakeholders interviewed. This allowed the experts to follow the content of the discussions and to intervene in case necessary. However, the partial translation caused in some cases also confusion and the loss of information.
4. Due to language differences, it was necessary to dedicate every day of the field work considerable time to translate the information gathered during the interviews from Vietnamese to English.
5. During the field work there was no time, nor budget available to make a risks assessment (making use of a combination of pesticide properties and local circumstances such as use patterns, soil, climate etc.). For this reason, the environmental analysis was based on a hazard assessment.
6. Due to the limited knowledge of English of the representatives of AGI, extra time was required to translate to English the data collected by them.
7. Regarding the meetings with the stakeholders, the logistics and coordination was delegated to representatives from the local government (DAO and CAO). In the case of the meetings in Sapa, this caused less than optimal settings, since the people to be interviewed seemed to be informed late, and with limited time to attend the researchers.
8. Due to time and budget limitations, the rose expert only visited the Me Linh region. For this reason the report presents just limited key expert observations on technical issues on rose cultivation in Sapa.

5. Research objective one: Rose cultivation and plant health

5.1 Introduction

By means of a transect walk of the area with the farmers, followed by several semi structured interviews (SSI) with growers, pesticide sellers, flower collectors (traders), flower buyers, etc., it was possible for the researchers to obtain a very detailed impression of the cultivation practices with special emphasis in all those activities having an influence on crop health and product quality. Two areas have been visited: the area around Me Linh, and the area around Sa Pa. First the information about Me Linh area is presented; those aspects in which the Sa Pa cultivation differs from the Me Linh cultivation are mentioned separately. The information collected is structured in three main chapters: general aspects of cultivation, general aspects of commercialization and flower quality, and general aspects of pest management.

5.1.1 Me Linh district

Me Linh district includes 17 communes, of which flowers (mainly roses) are grown in 10. Me Linh was chosen as one of the research sites, since rose production had the largest impact on poverty reduction compared to other communes in Me Linh District.

The total area of the Commune is 850 ha, of which approximately 440 ha is cultivated. Me Linh commune started rose cultivation in 1993. The sector flourished especially during the period 1997-2001. To improve the rose quality, growers replaced their local variety with the Da Lat rose in 1997 (Quang et. al., 2005). In 1999 the Da Lat rose was replaced by the French and Italian roses which have thicker rose petals and stronger branches.

Currently, Me Linh Commune has 250 ha of rose production, accounting for 63% of the total area cultivated. Additionally, farmers from Me Linh Commune, rent 30 ha. of cultivated area for rose production from other communes. In Me Linh commune, 95 % of the households work in rose cultivation. The average area per household: 1.500 m^2. Some growers have several plots scattered around the village (both owned and rented). The most used area unit by growers is the 'sao'[1].

The population of approximately 11,000 people represents 2500 households. They reside in 11 hamlets. Three hamlets, Duong, Hoi and Lieu Tri, were selected for interviewing because of the importance of rose production for the increase of wealth of these areas.

[1] 1 sao equals 360 m^2. Around 200 of the 2.375 roses household have 1 mau of planting area (1 mau is 10 sao).

The average farm size is about 1,500 m^2 (see 2.4.2.6.1) They are all family plantations in which growers sometimes cultivate different crops, like vegetables, banana's, rice and roses. Fields of different farmers are separated from each other by narrow paths (picture 5.1).

Picture 5.1 Narrow paths separate fields from different growers or different crops

The paths are used to reach the plots and transport tools, materials and harvested products, but are also the places where plant waste from the fields (rice spikes, removed weeds, banana leaves) is gathered together in piles, as it shown in picture 5.2.

Picture 5.2 Piles of plant waste are left in the paths that separate the fields

During the field visit some household waste was also found on the paths. Among the cultivated plots we could see a few 'abandoned rose crop plots'. These are plots in which a rose crop is not being taken care of anymore due to land expropriation by the government. The crop is dying but has not been removed yet. The fields are clearly separated from the village and no buildings or shelters for tools or product collection are seen among cultivation plots, which means that growers must transport daily all cultivation equipment and tools to the fields.

Roses are obviously a 'preferred crop' because they need less handling work than vegetables, and bring up 5-7 times as much as rice and 3-4 times as much as vegetables (although according to all interviewed, prices are dropping at the moment). However, roses require more pesticide input (about 3-5 times more pesticides than vegetables) and more work for spraying (due to the higher application frequency: three - four times per month in roses instead of once- three times a month in vegetables).

The rose production area in Sapa is smaller (about 55 Ha) than the Me Linh area, and younger (cultivation started around the year 2000). From this area, 14 Ha are being cultivated by a large scale farm (ATI) which seems very well organized. Besides that, there is a second 'big' rose company, 6 cooperatives (each with 3-7 farmers), and 26 independent rose growers. The area is being cultivated by small farmers in a very similar way as in Me Linh area. Although the district has made effort to encourage farmers to join together in cooperatives, not all farmers have followed this advice.

5.2 General agronomic aspects of rose cultivation

5.2.1 Cultivation period and flower production

Me Linh

Roses are a multi-perennial crop; this means that once planted, the plants remain in the field for several years (most growers indicate to replace after 7 years). In Me Linh area, planting can be done at any moment of the year, but one preferred moment by growers is March/April, which allows the grower to obtain the first good harvest and sell it using the opportunity of the Tet festival, one of the special celebrations of the year taking place around the end of January/ early February. In this period prices are high due to the high demand. During the 7 years that the crop life cycle lasts, the *plants produce roses the whole year round*. The time from sprout till harvest varies depending on variety, temperature and harvest method; on average it usually takes about 5 weeks, but because one plant has more sprouting points, and they do not sprout all at once, flower production is continuous.

Within the 7 year cropping cycle there are certain relative production differences (see figure 5.1): the first four months after planting are not productive. The first year the production in number of stems or roses is low (according to growers less than 30.000 roses per sao (83/m^2). The second year it increases and stabilizes in the years 3, 4 and 5 at around 100.000 roses/sao/year. After the fifth year, the production starts declining, and around the 7^{th} year growers usually replace the old plants by new ones.

Growers indicated to have observed a relationship between the first years of the cropping cycle and the pest/diseases incidence and consequently the pesticide use (see 5.4): the first years (1 to 4) mainly to observe pests and from year 4 mainly to observe diseases.

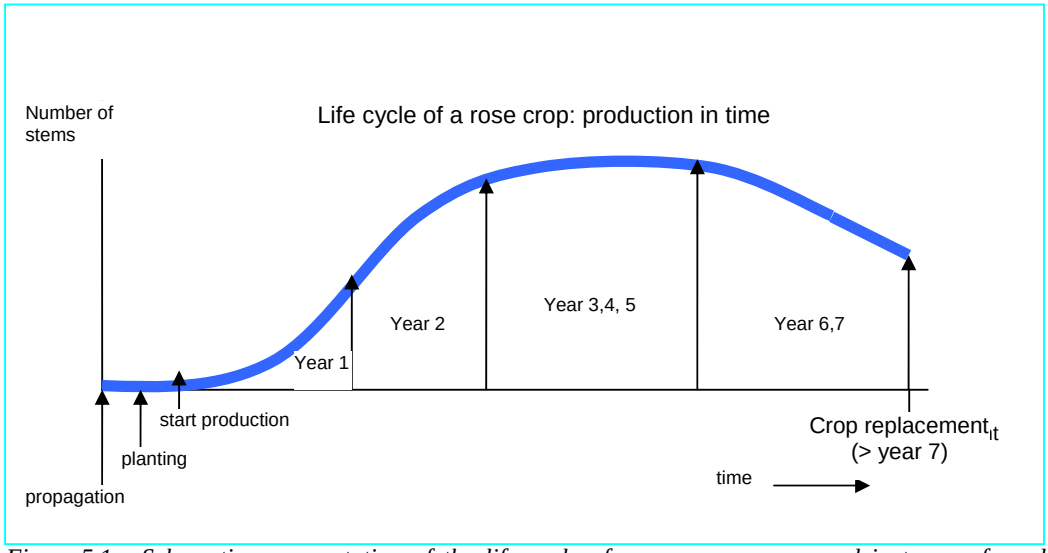


Figure 5.1 Schematic representation of the life cycle of a rose crop, expressed in terms of production (relative number of stems) during a 7- year time span

In a feed back meeting the figures related to the annual production (within the 7-year cropping cycle) were ratified by several growers. However, a second feed-back meeting, with relevant personalities in the area (among whom the Head of the Extension Office of Me Linh) where no growers were present, these numbers were found too high. Although it was considered that these were probably the right production numbers, it was suggested by them that only 60% of the production would be having sufficient quality, and the other 40% would be rejects.

Within the year, although there is always flower production, growers distinguish two periods in terms of flower production: a low season (May, June, July, August and September) and a high season (October till April/ may), as it is schematically shown in table 5.1. The low season correspond to the warmer months of the year, therefore the production cycle is shorter and more flowers are produced by the plants, but the quality is usually lower. The stems are shorter, and thinner, and the flower buds much smaller. The prices paid for these roses are lower due to the inferior quality. Independently of the quality, during a festival period a grower can obtain as much as 2500 D/rose; in the low season prices can drop down to 50 D/rose or 10 D/rose head (sometimes sold by growers for funeral arrangements, etc.)

Pruning just before the low season starts helps to improve this low quality by limiting the total production.

Table 5.1 seasonal calendar in a rose crop (year-round round production): the influence of the season on the relative rose production, rose quality and frequency of pesticide use

Month of the year	1	2	3	4	5	6	7	8	9	10	11	12
Pruning												
Harvest	High season				Low season				High season			
Production	Low				high				low			
Quality	High				poor				high			
Price	High (200D/rose)				Low (100D/rose)				High (200D/rose)			
Pesticide applications*	3x/month		4-5 x /month				3 x /month					
Pesticide concentration*	normal		higher				Normal					

* *indicative values*

In table 5.1 it is also indicated what was the average price obtained by the interviewed growers. The green shaded cells correspond to the rainy season.

Sapa

In the cultivation period Sapa differs from Me Linh, mainly because of the climatic conditions. Due to this, the flower production is *seasonal* instead of *year round* (from April till December). The life span of the plants is still considered to be 7 years (though the production only started in 2000), but farmers are convinced that well taken care, they can keep the rose plants for around 10 years.

The Sapa growers prune the plants in February and after pruning they fertilize.

Productions are much lower than in Me Linh area: they plant at lower densities than Me Linh growers (see 5.2.1.2 cultivation method, below), and due to their seasonal character, they only can harvest during a limited period of the year. Therefore, the production is only 5-7 stems per plant per year (20 to 30 stems/m^2/year). According to the growers almost all roses are saleable and therefore the percentage of rejects is very low.

The average price is 800 dong per flower (4 times the average 'good season price' of the Me Linh roses). The highest price is 2000 dong per flower and lowest price is 300 dong per flower.

The prices ATI (the big company) obtain for their roses are in the same magnitude as those obtained by the small farmers in the area: the ATI representative told the researchers that their average price of a rose in 2005 was 700 dong. Current price is 1100 Dong. In the rainy season the price can sometimes reduce to 400 Dong per rose.

Besides roses, in Sa Pa there are some experiments being carried out with growing orchids (500 m^2).

5.2.2 Cultivation method

Roses in both studied areas are grown directly in the soil in the open fields (no greenhouse or shade houses were seen in Me Linh area, nor in Sa Pa area). Soil preparation is limited to manual, animal traction or mechanic plowing. Usually no soil disinfection chemicals are applied. Some growers spray a herbicide on the just plowed land (see picture in page 54), although this is not the most common practice (the growers we walked with were surprised about this practice).

The plowing results in a system of banks and troughs. The bank is the cultivation bed (+/- 1 meter wide) and the troughs separate two beds. Only two row systems (two rows of rose plants in one bed, (see picture 5.3) were observed. (In a two row system, the spraying of the foliage in between both rows is difficult).

Picture 5.3 Rose plants are distributed in a two-row system

Plant densities vary from 1500-1600 plants/sao (4.1 to 4.4 plants/ m^2) in the Sa Pa area, to 2000 to 2150 plants per sao (5.5 to 5.9 plants/m^2) in the Me Linh area.

5.2.3 Irrigation

The water used for irrigation is obtained both from deep wells and from surface water, depending on the place where the farm is located. The bore holes are mostly between 18 and 30 m deep.

The water is brought to the plots by means of pumps (picture 5.5). Crop irrigation is done by flooding the troughs between two beds (picture 5.6). We have not seen any plots with drip lines for irrigation. Drip lines contribute to an efficient use of water and nutrients and therefore, to plant health; drip irrigation is the most common practice in big scale commercial rose cultivation (*note of N. Garcia)*.

Picture 5.5 Pumps bring up the water for irrigation of the fields

Picture 5.6 Irrigation of the fields is done by inundation of the troughs between the beds

5.2.4 Fertilization

According to the interviewed farmers, only a few apply fertilization by mixing the fertilizers through the soil *before planting* (*base dressing*). Those who do it, apply a mixture of organic fertilizer (chicken manure) and chemical complex (NPK) fertilizers. Most growers wait 2 months after planting the roses for the first fertilizing.

Growers usually top-dress several times a year: twice a year (after pruning, usually April and September) a combination of chemical and organic fertilizer is mixed through the soil. Between November and April one or several applications of (solid) chemical fertilizers are spread on the beds and then irrigated to allow dissolution and penetration through the soil. (Due to irrigation by flooding of the ditches, directly after fertilization, lots of fertilizers are possibly being leached to the lower soil layers).

SaPa growers explained to use fertilizers only after pruning in February. The ATI representative provided a list of synthetic fertilizers used, from which it can be concluded that mainly complex fertilizers are used, that some macro elements are not being supplied (or other chemicals are being applied but we were not told), and microelements are being supplied in high amounts. Complex fertilizers make adjustment of the supply to plant needs very difficult: there is always an excess of some elements and a shortage of other elements, (*note of N. Garcia)*.

The interviewed growers of the cooperative in Sapa believe there is a relationship between the use of fertilizer and vase life of rose after harvest. From their explanations, the researchers conclude that there is a lot of miss-information about the needs and the effects of fertilizers on rose production and quality.

5.2.5 Crop management

The crop is grown in a vertical way (no bending of branches). Twice a year (November and April) the crop is pruned (cut back) to avoid the harvestable stems from becoming too thin.

Besides harvesting, one of the most labor intensive activities during the rose production is covering the flower buds (picture 5.7) with a protective piece of newspaper or a page of the telephone book. This is done for a number of reasons: to improve the bud shape, to delay the flower bud opening and to protect the bud from bruising during handling. The yellow pages are the preferred paper due to its light weight and lower water absorption compared to normal newspapers.

Disbudding (removing side- sprouts) is not a normal practice. Either the cultivated varieties are less sensitive to side sprout production than the varieties cultivated elsewhere, or the paper rolling of the bud has an inhibiting effect on the side sprouting. Only a few stems (in the field and also in the cold store) showed side sprouts.

Weeding is done depending on the grower, either manually or by means of a herbicide. Manual weeding usually means twice a month a weeding day, or once a month a herbicide application. Some growers combine both systems; manual weeding in the cultivation bed and by means of herbicides in the troughs between beds and the plot edges. The main reason to use herbicides for weed control is the cost: Costs for a weed control spraying herbicide: 10.000 Dong/time/sao, while the costs for manual weed control are

30.000 Dong /person/day and according to the interviewed growers, two persons or one person for two days are required for weeding one sao (this figure was not checked with other grower groups).

Picture 5.7 Flower buds are covered with paper

5.2.6 Choice of rootstock and varieties

All interviewed growers in Me Linh use the wild variety 'Sweet Briar' as rootstock and graft (or buy grafted plants) with a commercial variety. Growers normally do not know which variety they are cultivating, because the young plants are not bought from professional breeders under a license (the usual way in commercial big scale rose cultivation, *note of the author*), but growers bring a few stems from the market and graft their plants with these varieties. The interviewed growers cultivate 95% red roses, only 5% other colors (but in the cold store we saw about half red roses, and the other half of the cell was other colors). Bud sizes and stem lengths seen in Me Linh correspond to varieties among the sweet-heart and intermediate.

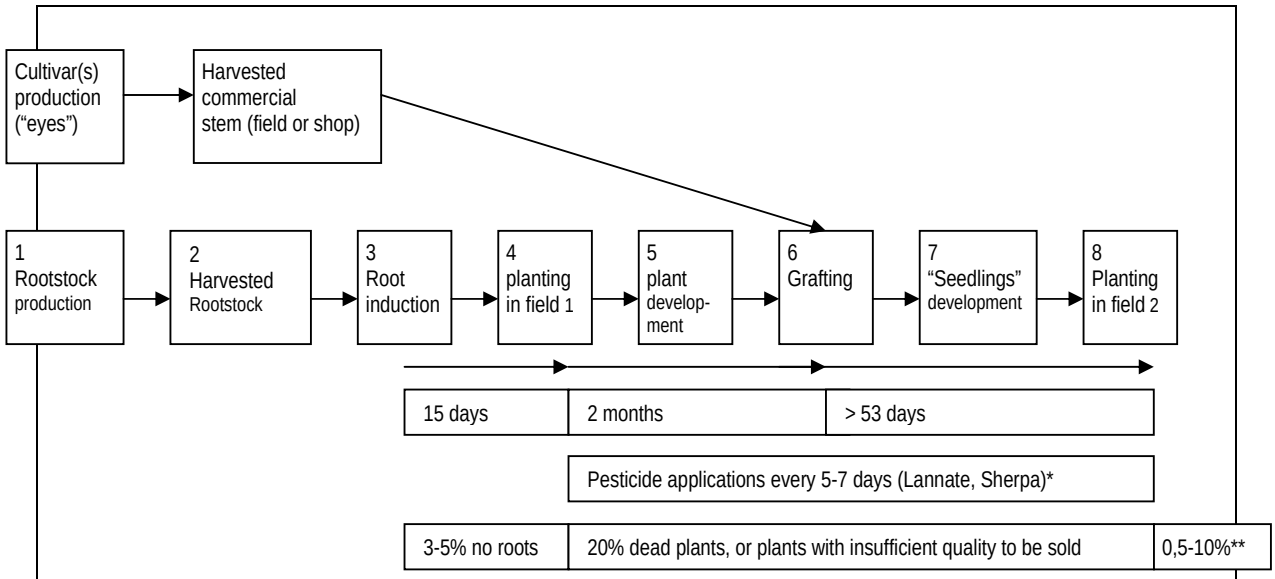
For Sa Pa area, ATI buys roots- stocks from the Me Linh commune and do their own grafting from varieties of Holland or France. Four different kinds of varieties were observed during the field visit: One white, one pink and two red (one from France and one from Holland). Concerning the small Sa Pa farmers, no information was obtained about the varieties they grow. To be judged by the stem lengths and bud size seen on the market, Sa Pa varieties are T-Hybrids (see picture 5.8).

Picture 5.8 T-hybrid varieties from SaPa (left) are sold on the market next to Me Linh sweethearts (right). The protecting paper covers the buds as the flowers are offered on the market

5.2.7 Propagation method

The most used propagation method is by means of 'seedlings'. These are young grafted plants of about 4 to 6 months. Some growers propagate themselves; others buy rooted rootstocks and graft them themselves. A third category of growers buy the grafted seedlings from a professional propagator. The complete process as described by one of these professional propagators is shown in the figure 5.2 below.

Allbritton e.a. (2005) report prices varying between 600 and 1300 Dong per seedling depending on the variety. In Sapa area, the price for a seedling is around 800 Dong.



1) Own field where a wild variety (sweet Briar) is cultivated
2) Harvested, deleafed rootstock stems are cut to 20 cm segments
3) After a rooting hormone dip, the rootstock segments are bundled and planted in a sandy bed and left there for 15 days (picture 5.9, right)
4) Rootstock segments with visible root primordia are planted in the field at a density of 10.000 plants/sao
5) Rootstock segments will develop roots and aerial parts (shoots) develop during 2 months
6) The developing young plants are ready to be grafted by 'occulation': the 'eyes' (axillary buds) are removed and replaced by the 'eyes' of the variety, held on their place by a piece of tape.

7) The grafted eyes will sprout on the rootstock and the plants are allowed to develop during +/- 53 days, then be uprooted, quality controlled (root colour and development of roots and aerial parts must meet the customer criteria: sufficient length, white colour (roots) and nice green foliage (aerial parts). Plants with brownish roots will receive a chemical root treatment with a fungicide and be left a little longer in de field
8) The good plants ('seedlings') will be sold to a rose grower and be planted in the field at a density of +/- 2150 plants/sao.

*The young plants are very sensitive to fungal diseases, worms and caterpillars, insects and mites and therefore often sprayed
** Percentage of rejected plants per phase: only 0.5% of plants die after being delivered to the growers in winter, maximum 10% die in summer; in total the success percentage is around 70 %.

Figure 5.2 Propagation process as described by Mr. Nguyen Duc Manh, propagator

Portrait of a rose propagator:

Mr. Nguyen Duc Manh, Male, 28.

From 1995 to 1999 he worked for other growers. Since 1999 he started his seedling production, first for his own family's rose production, then, he started to sell seedlings to other growers.

Besides his own land, he also rents area from other communes for his operations.

At present, Manh is involved in four main activities:

- *Rootstock production: he has a plantation in which the wild variety is grown for harvesting rootstock.*
- *rootstock rooting (root induction), sells a piece of rootstock with a root induced (500.000 per year)*
- *seedling production: he grows and grafts the root-induced rootstock until a well developed plant (30.000 per year)*
- *rose production: he has a rose plantation (for selling in the market only in some special occasions (Women's Day, the first day of the Lunar month…).*

Manh buys the varieties (the rose eyes to graft the rootstock with) from villagers, from a private seedling centre in Gia Lam and Hanoi, from other farmers in his commune, and just from the market.

Some of the plants are propagated "on demand", others he produces by his own initiative and sells them when they are ready; in such cases he decides himself which variety to use.

He did not learn from training courses and workshops. He learned from others' experience and his own work experience.

5.2.8 Harvest

Harvest in Me Linh is mainly done once a day by women. We were not able to see any harvesting in progress. Because the flowers are covered with the paper, the ripeness of the flower (cut stage) is not taken into account to decide which stem to harvest. (Cut stage is one of the most important harvesting and quality evaluation criteria in big scale commercial rose cultivation, *note of the author*).

In Sapa, harvesting frequency is even lower: only once every 3 days at ATI, and once every four days is the normal frequency for the interviewed small growers. (This is a very surprising practice for the research team since most varieties grown for export in South America and East Africa requires several harvest rounds a day, *note of the author*).

To observe the quality of the harvest and classification, some bunches were bought, opened and examined (see post-harvest performance). A large number of the stems were not harvested correctly; the stems were cut by 'undercut' (picture 5.11), which gives the impression of a longer stem, but is in fact a piece of the previous order lateral shoot.

Picture 5.11 several stem lengths, stem thickness and ripeness stage are found in one bunch

5.2.9 Rose post harvest handling and storage

Harvested roses in ATI fields (Sa Pa) are brought to the bamboo house (a shelter) and in the afternoon they are transported to Hanoi. The small Sa Pa growers bring the harvested roses out of the farm and clean them with water to give a fresh appearance. In the afternoon they bring the roses to the big road, then the truck comes to collect the roses to bring them to Me Linh. Sometimes, flowers are kept at home for several days in a shelter to be protected from the wind. A few cooperatives have their own truck for transport to Me Linh.

Me Linh farmers collect the harvested flowers on the floor next to the field. After harvesting, the flowers are packed together using a plastic bag that is wrapped around the roses. Then the farmer carries roses to his house on a motorcycle or bicycle. The flower is not put into water until they arrive at home. It was told that farmers put flowers into a 5-10cm water deep bucket after arriving home. However, this practice was not observed during the field visit. If the roses are kept in the cold store, flowers are washed with clean water and kept outside to allow drying out before storage. In the cold store they are not put into water.

Two cold stores were visited in Me Linh area. Not every grower has a cold store. Only those who (besides growing) trade with roses (the collector) have such. Currently, there are 40 of these cooling stores in Me Linh commune.

The cold room is a concrete space with an air conditioning system, and a deepened floor which is filled with a layer of water (they get in it with rubber boots or sandals, see picture 5.12).

Picture 5.12 The floor of the cold store is filled with a layer of water

The flowers are laid down horizontally in huge piles, all in the same direction, to the middle of the room, or in layers in which the flower orientation is alternated (picture 5.13).

Picture 5.13 Flower storage in the cold room

The collector keeps the roses in this cold store for a maximum of 14 days, because, in their perception, if kept longer they get very bad and are difficult to be sold since they loose the fresh appearance. The reason to keep them for so long is to wait for a good price in the market.

From (the author's) quality point of view, this storage practice is very detrimental: the flowers underneath the pile will be damaged by the weight and the thorns of the flowers on top; the wet cell will also allow the germination of the fungus *Botrytis cinerea*, which leads in the worst cases to rotting of petals and whole stems.

5.2.10 Post harvest performance

To get an impression of the post harvest quality (from our European point of view) we bought average roses from a collector. One fresh bunch of yellow roses and two bunches of red roses, one 'fresh' (one day old) and one 'stored' (the collector could not tell the number of storage days).

The flowers were placed in water during two hours before observation to allow recovery from dehydration during transport from the collector's house to the AGI building. Two aspects were evaluated: both bunch and individual flower presentation (by visual observation) and vase life (by placing half a bunch in an improvised vase, then conducting daily visual observations until vase life was considered terminated). Picture 5.14 shows our improvised 'flower testing room'. The room was air conditioned and the curtains were mostly closed, preventing direct sun light to enter the room.

Picture 5.14 An impression of the improvised 'flower vase life testing room'

Presentation

Considered from the European - North American quality standards, the purchased bunches showed a number of quality remarks:

- About 30% of the red roses and 10% of the yellow were incorrectly harvested (cut by 'under cut'): this means that stem length looks like 60 cm but is in fact less than 50 cm
- A bunch composed of roses of all lengths (not length-classified)
- A few stems were not straight
- Great differences in flower ripeness (due to covering paper not visible)
- Bud covering paper were still present (needs to be removed by purchaser = damage is hidden!)

- About 10% of flowers showed *Botrytis* (a fungus) lesions
- 10% showed holes in petals (presumably caterpillar damage)
- Lots of pesticide residue was found on the leaves
- Some other leaves showed yellowed leaves with lesions
- Bunches were composed of uneven number of stems.

Vase life

After observation, the lower 3-5 cm of the stem ends were re-cut with a knife and half of the flowers in each bunch were placed in one vase containing clean water for an indication of vase life. The vases (two per bunch) were placed at the meeting room from the AGI building. This room was air-conditioned part of the time and the curtains were closed.

From the moment of placing the flowers in the vase (day 0), a daily observation was done. Those flowers without ornamental value left were recorded and discarded; the number of days from placing on the vase till discarding is defined as 'the vase life' of an individual flowers. From each vase, the average vase life was calculated. It varied from *1,8 days* (old red) to *3,6 days* (fresh red). The yellow flowers had a bigger leaf area, which usually indicates a higher transpiration rate and had an average vase life of *2,5 days*. The main reason for vase life termination of the red flowers was bent neck; of the yellow flowers it was premature wilting (see pictures 5.14a and 5.14b) by dehydration (the flowers lost more water through transpiration than they are able to absorb through the xylem vessels of the stems).

Picture 5.14 (a & b) Aspect of the flowers in the vase on day 2 of the vase life test

The flower bud opening was also observed. The red flowers were harvested quite unripe, therefore, only three of the 45 flowers opened during vase life. The yellow flowers,

on the contrary, popped all open directly after removing the covering papers, which suggested the ripeness was more advanced than in the red roses, in fact, too advanced, but kept from flowering by the paper.

Several consumers we asked corroborated the vase life of the flowers they buy is usually 2 to 3 days. Because of the harvest and post-harvest circumstances (uneven ripeness, storage not in water, etc.), this short vase life is not surprising to the researchers, but it would be too short to compete in markets that are served from established exporting countries (see also 7.5.1). Important to note is that because many flowers are used to offer in temples, vase life is not an important criterion for this use, but it is relevant for the exclusive flower shops in Hanoi and for the export ambitions of involved parties, as expressed in a number of interviews by different actors.

5.3 Pest and diseases in rose production

5.3.1 Me Linh

Together with the farmers one rose field of a 4-year old crop was visited. This turned out to be a very good discussion object since the farmers were able to show examples of leaves, buds and stems affected by pests and diseases. The farmers were able to identify quite well a number of pests and diseases, but others were difficult for them to identify due to insufficient knowledge. They indicated to have received trainings on PD diagnose from Plant Protection Department at District level. However, these courses were not specific for rose pests/ diseased but general (vegetables). They also acquired this knowledge through the pesticide suppliers, who showed pictures of diseases and taught them which pesticide to use for each disease. The farmers did not have much experience with dying crops in the early stages of the crop cycle. Plant death is happening sometimes after 5 years of cultivation.

It was observed that the identification of insects (trips, red spider mite) is rather accurate. This is not the case for the identification of fungal and bacterial diseases. For instance, farmers confused the symptoms caused by certain fungal diseases with an insect damage, and nutrient deficiencies as well as pesticide damage were confused with fungal diseases. They do not have the possibility to send samples to a laboratory for determination of the pathogen. Moreover, the knowledge about plant deviations (abnormal color or spots not caused by pathogens but by nutrient deficiencies or even by pesticide damage) is very limited.

In all the visited fields a lot of residue of pesticides was observed on the leaves (picture 5.15).

Picture 5.15 Close-up showing pesticide residue on the foliage

The presence of residue on the leaves is an indication of the quantity of pesticides used, but also of the way pesticides are applied: wrong size of the drops - inadequate, broken or obturated nozzles- , no use of dispersion agents, wrong moment of application (*note of N. Garcia*).

At the plot next to the discussion object, an older crop (5 year) of the same variety (according to the farmers) was showing a much better health condition. Although there was some visible pesticide residue, the crop had a lot more foliage, more stems, lots of young shoots, bright intense color and twice the size. The plot belonged to another grower, which could be an indication that in the area growers of different knowledge level and skills are active.

Back in the office the farmers worked on elaborating a list of pests and one of diseases they usually encounter. They prioritized in importance, and the relations of the pests with climate and varieties were discussed. Tables 5.2 and 5.3 show an overview of the answers, and were possible; the information has been completed by Nieves García and by Vu Duy Thanh.

Besides these diseases listed by the growers, also the presence of tumours caused by the bacteria *Pseudomonas tumefaciens*, and the fungus *Botrytis* was observed both in the field and in the harvested stems. The fact that these diseases were not mentioned by the growers could indicate that they do not know them or they are not aware of the severity of the diseases.

Table 5.2 The pests with the highest incidence in Me Linh area

Importance	*Local name*	*English name*	*The most serious period*	*The least severe period*
1.	Bo tri	Thrips	May till September	December till February
2.	Rep sap	Aphids	May till September	October till April
3.	Ray nau	Plant brown hopper	May till October	November till April
4.	Ray xanh	Plant green hopper	May till October	November till April
5.	Ray trang	Plant white hopper	May till October	November till April
6.	Nhen do	Red spider mite	September till April	May till October
7.	Nhen trang	White mite	November till April	May till October
8.	Sau xanh	Helicoverpa* (caterpillar)	March till July	August till April
9.	Sau to (sau khoang)	Spodoptera* (caterpillar)	March till July	August - September

* Information Cao Hong Luyen.

In the feed back meeting, the District Officer added 'rot san' in English 'root knots' as one of the serious problems for growers. Root knots can be caused by three different organisms: bacteria (*Agrobacterium tumefaciens* or the earlier mentioned *Pseudomonas tumefaciens*) and nematodes (*Meloidogyne hapla*).

Table 5.3 The diseases with the highest incidence in Me Linh area

Importance disease	*Local name*	*English name*	*Caused by*[1]	*The most serious period*	*The least severe period*
1.	Nam Phang Trang	Powdery mildew (White fungus)	*Sphaeroteca panosa*	October to March	November till February
2.[2]	ri sat (gi sat)	Rust	*Phragmidium mucronatum*		
	Dom Den	Black spot?	*Diplocarpon rosae*	May till September	October till April
	Dong vong	Downy mildew?	*Pseudoperonospora sparsa*		
3.	Chet Cay	(black stem, whole plant is dead)	*Colletotrichum sp.* or Stemborer (insect)?[3]	After the 5th cultivation year	

1) information Nieves/Thanh;
2) growers were uncertain about which disease they meant with these terms; these three fungus give spots on the leaves; they can not identify which is the causing organism;
3) information Thanh, still uncertain. Other possibilities (Nieves) include other fungi like *Coniothyrium, Lasiodiplodia* or *Botrytis*. Further determination needed.

5.3.2 Sapa

Roses are grown in Sapa since 2000. The pests/disease incidence has increased in this period of time. At the beginning the pests/disease damaged around 30% of planting area,

now it goes up to around 70%. The tables below show the most common pests (table 5.4) and diseases (table 5.5) for this area.

According to the manager of ATI, Mister Nguyen Van Cu, the farm deals with one disease which is very special and serious (fungi) and they use 'Alliette' to control this disease. Normally, the most serious period is from September to December but in years with very high humidity the problem remains till February next year. Because it was not possible to meet the person responsible for the technical management of farm activities it was not possible to confirm the English name or the cause of the disease.

Due to the controlling agent used (Alliette), it is assumed that it concerns a root disease caused by the soil borne pathogenic fungi *Pythium* and or *Phytophtora*, usually attacking in growing conditions of excessive watering (by irrigation or rains). But there are several other soil borne fungi to be considered as the organisms they try to fight by means of this chemical. The use of 'Alliette' was not mentioned by the Me Lihn growers at all; the Me Lihn propagator was the only person who mentioned the use of a fungicide against root fungal diseases (see figure 5.2).

In this region, the growers also have problems with caterpillars and mites. However, caterpillars are not mentioned by the growers when asked to indicate the most serious diseases.

A surprising important difference with the main diseases mentioned by the growers in Me Linh area, is the incidence of the 'Chet cay' or 'dead plant disease' (see tables 5.3 and 5.5) in a much earlier phase of the plant life cycle. The reason lies probably in the causing organism, since there are many different pathogens causing vascular diseases that lead to dead plant. Against some of these pathogens there is no effective chemical treatment. This shows that a more accurate diagnose is needed before a successful control measure (pruning, removing a dying plant or applying the right pesticide) can be recommended.

Table 5.4 The pests with the highest incidence in SaPa area

Importance	*Local name*	*English name*	*The most serious period*	*Remark*
1	Nhen do	Red spider mite	In between seasons	
	Nhen trang	White mite	In between seasons	
2	Sau can re	Root borer	young plant (after planting 2-3months to 3 years),	the color of body is white, the head is black
3	Bo tri	Trips	All year round	on young leaves, top of plant and flower

* Identified by Vu Duy Thanh

Small growers visit the fields twice a day (in the morning and afternoon) to check the situation of the crops (including pests and diseases). There is a general diagnose service available provided by the Extension office of the local Commune Committee. However, they have limited knowledge and experience with roses, for which growers tend to rely more on other growers for learning on the pest or disease they have and the adequate pesticide to be used. They use their experience in cultivating vegetables and grains and learn from each other regarding the specific characteristics of rose cultivation. Because the area of flowers is increasing, the farmers requested the DAO (district agricultural office) to

provide information on pesticide use, what lead to DAO support for the opening of a pesticide shop in Sapa (An Phat shop) in 2006. The shop has helped the growers to get information about pesticide use from the pesticide provider since 2 months ago. Nevertheless, most growers still rely on the experience and knowledge of other growers in Sapa and Me Linh.

Table 5.5 The diseases with the highest incidende in SaPa area

Impor -tance	*Local name*	*English name*	*The most serious period*	*Remark*
1	Rung la hang loat (Nam lua)	(*Phytium* or *Phytophtora**)	Feb.-Mar. and June to July	
2	Dom vong	Downy mildew	May to June	See table 5.3
3	Chet cay	Dead plant	Feb. to Mar. (after planting 1 month till one year) and Jun. to Jul (for plants that are over one year)	See table 5.3
4	Nam phan trang	Powdery mildew (White fungus)	rainy and cold weather	

* Presumably this are the causing fungi of this disease, judged by the product used to control it. (*Note from N. García*)

5.4 Pest control strategies by rose farmers

5.4.1 Integrated pest management

The interviewed farmers do not apply any non chemical methods for pest and disease control.

Some of the growers in both Me Linh and Sapa area, indicated to scout for pests. Scouting before applying pesticides is considered to be the first step towards integrated pest management. Knowing which kind of pest is present in the crop and choosing the pesticide to use according to this information is a better practice than spraying on a program basis.

Essential for a proper scouting is a thorough knowledge of the symptoms caused by pests and diseases, and assistance by a serious diagnostic service. Otherwise scouting or reactive spraying will result in pest control by 'trial and error'. This leads to abusive and sometimes inadequate or unnecessary use of pesticides.

When detected a plague in one or more plants in the crop, growers do not limit the application of pesticide to the affected plants (local applications, preferred practice from an IPM point of view), but sprayed the whole field.

Disease prevention is another pillar on which integrated pest management is sustained. During the fieldwork the impression was obtained that

- There is insufficient awareness of the impact of fertilization and irrigation management on the susceptibility of the plants for pests and diseases.
- There is insufficient conscience on the impact of hygienic measures to prevent the spread of diseases.

- the knowledge about curable and non- curable diseases is insufficiently present (spraying incurable diseases only leads to unnecessary use of pesticides, when removing of affected plants is the only way to get rid of such diseases).
- the negative effects of pesticides on plant production and plant health are not sufficiently known.

5.4.2 Chemical control

The use of chemicals is the only pest control method used by the interviewed growers in both areas.

5.4.2.1 Application methods

Most pesticides product is diluted with water in a bucket. This solution is then poured into the spray tank. If the producer mix different product together they will dilute the second product into a separate water bucket and put both products in the spraying machine. The same procedure is applied to the third product. The pesticides are applied with the spray mast connected to a tank that is carried on the back, and a small engine pump that pushes the fluid out under pressure.

Normally men spray the pesticides. From the interviewed group of Me Linh Commune three of the eight women only spray in about 10% of the occasions, one of them sprays always because her husband is having another job.

In the field, growers spray pesticide on the upper part of the plant and then turn the nozzles up side down to spray the lower parts of the plant. Growers usually follow the wind during spraying.

Besides spraying some chemicals are applied by depositing them on the surface of the beds, then cover by soil or mixed with irrigating water. This is the case of pesticides against root diseases, like nematodes and the earlier mentioned *Pythium* and *Phytophtora* fungi. Examples of these chemicals are to be found on the tables of most commonly used pesticides 5.6 and 5.7 under the commercial names Alliette and Basudin.

Man preparing the tank for spraying pesticides

5.4.2.2 Frequency of application

5.4.2.2.1 Me Linh Commune

Two different ways to use pesticides were encountered: some growers do follow a pesticide program (calendar spraying), that leads to spraying three times a month from September to February and four times a month from March to June (rainy season). In this period they use a higher dose (see also table 5.1).

Other growers do not follow a special pesticide program; applications will be done as a reaction to the occurrence of symptoms (reactive) rather then preventive. These growers spray 4 to 5 times a month on average in the rainy season, in the dry season they spray 3 times a month.

5.4.2.2.2 Sapa

Individual growers
Normally growers in Sapa spray a pesticide once every 15 days (2 applications per month). As an average they spray about 4-5 different chemicals in one application. The growers can not explain why they are spraying every 15 days: They learned this from other people and based on their own experience.

Large scale producer, American Technology Incorporated (ATI)
ATI belongs to the group of growers following a pesticide program (calendar spraying). Besides the program, every day the technical person is checking the fields for diseases and pests. According to the manager, this person is trained to know which pesticide to use and which pesticide to mix.

In the dry season they normally spray every 10 days. If a problem is detected before the end of the 10 day interval, extra applications can be decided on the whole field (no local applications).

In the rainy season they still have the same program for spraying every 10 days and earlier if they see problems in the field. But when it is raining they have to delay the spraying. In general there are more problems in the rainy season; the amount of pesticides sprayed in this season is higher.

They don't use herbicides for weeding because they believe these products negatively affect the quality of the flowers. Due to this, they remove weed by hand once a month or once every two months depending on the season.

5.4.2.3 Different kind of pesticide products

5.4.2.3.1 Me Linh

Growers in Me Linh are using 20 to 40 different kinds of pesticides for their rose production. During the first two years of the production of roses the type of pesticides is focused on insecticides. After two years fungicides will be mainly used. Growers do not keep any record of the products used, when, how much, etc.

During a semi structured interview a set of commonly used pesticides borrowed from the shop were exposed on the table. Growers were asked to choose the ones they use more often and to tell against which pests and diseases they use them.

Growers discussing what kind of pesticides are used for the cultivation of roses

Table 5.6 gives an overview of the most frequently used pesticides in Me Linh according to the growers in the rose production. They are ranked in terms of frequency in use.

Table 5.6 Chemicals used for pest control in Me Linh Commune

Ranking	*Pesticide*	*A.I.*	*Purpose*
1	Mancozeb 80 WP	Mancozeb	Rust, Powdery mildew
1	Forthane 80 WP	Mancozeb	Powdery mildew, Rust
2	Score 250 EC	Difenconazole	Powdery mildew, Rust
3	Bumper 250 EC	Propiconazole	Rust, Powdery mildew
3	Sokupi 0.36 AS	Matrine	Thrips, caterpillar (Helicoverpa, spodoptera)
3	Tri Tau (Local name, no package available)	?	Thrips
4	Lannate 40 SP	Methomyl	Powdery mildew, Rust
4	Sec Saigon 50 EC	Cypermethrin	caterpillar (Spodoptera*, Helicoverpa*), mites
4	Tap ky 1.8 EC	Abamectine	mites, caterpillar (Spodoptera*,Helicoverpa*), aphids, hopper
5	Tilt 250 EC	Propiconazole	Rust, Powdery mildew
5	Daconil 500 SC	Chlorothalonil	Rust, Powdery mildew, black spots
6	Visher 25 ND	Cypermethrin	caterpillar (Spodoptera*,Helicoverpa*), mites (white and red)
7	Antracol 700 g/kg	Propineb	Powdery mildew, Rust
8	Mire tox 10 WP	Imidacloprid	Thrips, mites (white and red)

* Identified by Thanh and Nieves

The growers are convinced that the products they use are effective in controlling the pests/diseases.

Growers' attitude towards illegal products
The interviewed group mentions not to use illegal products normally. They know Chinese pesticides are illegal, and besides, they cannot read the label. Some very old products are forbidden, but this is something, that, according to them, everybody knows. However, in the fields, empty packages of Chinese pesticides are found, which indicates that not all growers share this attitude.

5.4.2.3.2 Sapa

Individual growers and ATI
In Sapa the amount of different kind op pesticides used for the rose sector is smaller than in Me Linh Commune. The growers explained to use 5 kinds of pesticides in most of the cases. Rarely some other pesticides are used as well. Table 5.4.2 gives an overview of the most frequently used pesticides in Sapa according to the individual growers in the rose production. They are ranked in terms of frequency in use.

Table 5.7 Chemicals used for pest control in Sapa

*Ranking*****	*Pesticide*	*A.I.*	*Purpose*
1	Alliette 80 WP 800 WG **	Fosetyl aluminium	Nam lua (rung la hang loat)***
2	Score **	Difenconazole	Black spot, Rust, Powdery mildew
3	Bumper **	Propiconazole	Black spot, Rust, Powdery mildew
4	Tri tau	?	Thrips
5	Daconil	Chlorothalonil	Black spot, Rust, white fungus
6	Lannate	Methomyl	Thrips, caterpillars (Helicoverpa*, spodoptera*)
6	Sec Saigon	Cypermethrin	mite and caterpillars (Helicoverpa*, spodoptera*)
6	Sokupi	Matrine	Thrips and caterpillar (Helicoverpa*, spodoptera*)
6	Mancozeb	Mancozeb	Black spot, Rust, Powdery mildew
6	Tilt	Propiconazole	Black spot, Rust, Powdery mildew
6	Antracol	Propineb	Black spot, Rust, Powdery mildew
6	Forthane	Mancozeb	Black spot, Rust, Powdery mildew
6	Tap Ky**	Abamectine	mites, caterpillars (Helicoverpa*, spodoptera*), plant hopper (green, white, brown)
7	Bazudin	Diazinon	Root borer (nematodes ??)

* identified by Thanh; ** Pesticides also frequently used by ATI; *** Soil borne fungus, presumably (N. García) *Pythium* and/ or *Phytophtora;* **** ranking based on frequency of use

From table 5.7 it is remarkable to observe that a lot of pesticides are comparable with the pesticides used in Me Linh Commune. However, this can be explained by the fact that a lot of growers from Sapa buy their pesticides at Me Linh Commune and rely on advice of outstanding rose growers from Me Linh.

From the interview with ATI the impression was obtained that ATI focuses on five different pesticides for the rose production: Alliette, Bumper, Score, Tap ky and Nam con co. It has to be noted that the interviewed manager is not the person who is responsible for the pesticides. It was not possible to interview the technical person.

The other growers use herbicides once in 2-3 months as weed-control in the ditches of the rose fields. In the beds of the rose fields they do not use herbicides. They weed it by hand.

Growers' attitude towards illegal products
Growers know Monitor is illegal pesticide (this hadn't been allowed using for a long time ago. They don't know which pesticides are not allowed to use in Viet Nam now. They think the Chinese pesticides without Vietnamese or English (only Chinese) are illegal. They still use illegal pesticides as 'tri tau' for about 5 - 10 % of the total amount of the pesticides.

5.4.2.4 Mixing of different pesticides

5.4.2.4.1 Me Linh commune

The growers were asked whether they mix the pesticides with auxiliary chemicals, like wetting agents (often recommended by the pesticides producing companies), foliar fertilizers or other products. The growers never use any of the mentioned products, but they have heard that in other regions alcohol is used (this information is coming from Luyen from other researches).

The group was also asked to explain which ones they normally mix together. This turned out to be rather difficult, because they make all kinds of combinations, and they change the products all the time. Growers reported that they usually mix three types of pesticides together for one application, mostly in order to save time. They're knowledge on mixing is partly based on their own experience and consulting the pesticide retailer to learn which products should be mixed to each other and based on their own experience. They think that the mixture of different types of pesticides (for different purposes) can help control all the current pests/diseases at the same time.

5.4.2.4.2 Sapa

Individual growers
Two to three pesticides are mixed together in one time in one tank. Based on the purpose of the pesticides the growers decide which kinds can be mix together. They don't mix pesticides which have the same purpose.

5.4.2.5 Amount of pesticides used

5.4.2.5.1 Me linh Commune

The growers agreed that the amount of pesticides used in the region in 2005 was two times higher than in 2000. This is due to the rose production, according to them.

In Me Linh there are 16 legal pesticide shops. Five of the shop keepers were asked to fill in a questionnaire. Table 5.8 gives an overview of the total amount of volume of pesticides sold in 2005 for roses at these five shops. The amounts of volume sold were given by the shop keepers based on their memory regarding the amount of pesticides they normally sell in one month.

The amount of pesticides mentioned in table 5.8 is sold to an estimated 1230 farms. These growers will not only go to these shops; they will probably also go to other shops. It is not possible to calculate the exact amount of pesticides used for one ha or sao because it is not clear how much pesticides these 1230 growers buy at other shops. It is possible to assume how much pesticides they will use as a minimum.

As indicated before, Me Linh has a cultivated area of 440 ha; 250 ha is used for production of roses. There are 2450 households in Me Linh of which 2200 are involved in agricultural activities (head of the extension office of Me Linh: Mister Nguyen Van Bay)

Table 5.8 Amount of pesticides sold in 2005 in Me Linh Commune (5 shops) to rose growers

Pesticide	*Active ingredient*	*Total amount or Volume sold in 2005*	*Total amount of AI sold in 2005 (kg)*	*Total amount of AI/ha*
Mancozeb 80 WP	Mancozeb	3000 kg	2400 (80%)	17.1 kg
Forthane 80WP	Mancozeb	1700 kg	1360 (80%)	9.7 kg
Score 250 EC	Difenconazole	139	34.75 (250 g/L)	0.25 kg
Bumper 250 EC	Propiconazole	165	41.25 (250 g/L)	0.29 kg
Sokupi 0.36 AS	Matrine	251		
Tri Tau (Local name, no package available)	?	60 kg		
Lanate 40 SP	Methomyl	154 kg	61.6 (40%)	0.44
Sec Saigon 50 EC	Cypermethrin	611	30.55 (50 g/L)	0.22 kg
Tap ky 1.8 EC	Abamectin	76	0.14 (1.8 g/L)	0.001 kg
Tilt 250 EC	Propiconazole	206	51.5 (250 g/L)	0.37 kg
Daconil 500 SC	Chlorotalonil	36 kg	18 (50%)	0.13 kg
Visher 25 ND	Cypermethrin			
antracol	Propineb 700 g/kg	-		
Mire Tox 10WP	Imidacloprid	190 kg	19 (10%)	0.14 kg
Total				*28.6 kg*
Pesticides sold by shopkeepers but not be mentioned by the growers				
Sherpa 10 EC/25EC?	Cypermethrin	465		
Anvil 5SC	Hexaconazole	240		
Cyperkill 25 EC ?	Cypermethrin	571		
Di het	?	244 kg		
So Ka	?	30		
Tilt supo (probably Tilt Super 300 EC)	Difenconazole 150 g/L + propiconazole 150 g/L	25		
Ofatox 400 EC	Fenitrothion	115		
Ben cut	?	4		

In Me Linh the governments divides the agricultural land every 20 years. When it is time to divide they count the members in the family book (except the family which have a permanent contract for another job, not as a producer). For example, someone has 7 numbers in the family. One has an official job and it is not possible to work in agriculture. 7-1 = 6 members get agricultural land. Every person in the commune gets the same amount of land. After 20 years the process starts again.

From the figures mentioned above it can be assumed that 1230 growers of roses have an area of 1230/2200 = 0.56 x 250 ha = 140 ha. The pesticides shown in the last column of table 5.8 will be used for one hectare. Of the total amount of 28.6 kg active ingredient per hectare, mancozeb is responsible for 26.8 kg!

Table 5.9 Advised dosage of pesticides in Me Linh Commune (5 shops)

Pesticide	*Purpose*	*Period*	*Advised dosage to producer (ml product/L water)*				
			(1)	(2)	(3)	(4)	(5)
Tap ky	Mites, insect	1-12	0.3			0,8	1,7
Sokupi	Mites, insect, thrips	1-12	0.3	2.0	0.3	1.6	1.6
Score	Fungus, Rust	1-12, (most 11-3)	0.6	0.6	0.8	0.6	0.7
Manco-zeb	Black spot & Powdery mildew	1-12	4.6 g/L	4 g/L	3.5 g/L	0.6 g/L	5 g/L
Sherpa	Insect	1-12	1.9	2	1.3	2	
Anvil	Powdery mildew	3-9	1.3		0.9		
Mire Tox	Thrips & mites	1-12, most: 3-9	1.3	1.2 - 1.6	1.3		1.8
Cyperkill	Insect	1-12	1.3	2			
Bumper	Black spot & rust	3-9	0.6	0.3		0.3	
Tilt	Fungus	1-12	0.2	0.3	0.6	0.3	0.5
Forthane	Powdery mildew, rust, black spot	1-12		4 g/L		5.6 g/L	5 g/L
Daconil	Powdery mildew, Rust, black spot	1-12 most: 11-3		4 g/L			
Sec Saigon	Insect	1-12		2	1.5		
Tri Tau	Thrips	4-9		1.2			
Di het	Thrips	1-12		0.8 g/L		0.8 g/L	2 g/L
So Ka	insect, mites, thrips	1-12		2			
TiLt supo	Insect, mites	1-12			0.3		
Ofatox	Insects	4-10				2	
Lannate	Insect	3-10				1.8	0.7
Ben cut	Powdery mildew	11-3					1 g/L

(1): Shop owner: Nguyen Nhan Doan, 250 farms; (2): Shop owner: Nguyen Thi Du, 245 farms; (3): Shop owner: Le Thi Oanh, 240 farms; (4): Shop owner: Nguyen Van Bay, 245 farms; (5): Shop owner: Tran Van Binh: 250 farms; Period: 1 = January …. 12 = December.

5.4.2.5.2 Sapa

According to the interviewed growers, the actual volume of pesticide used is 1.5 to 2 times more than in 2000, when the rose growing was initiated in the area.

5.4.2.6 Dosage of pesticides

5.4.2.6.1 Me linh Commune

Table 5.9 gives an overview of the advised dosage from the shop sellers to the growers to use for roses.

From table 5.9 it can be observed that different shop sellers advise different dosages for the same product.

5.4.2.7 Costs for using pesticides

5.4.2.7.1 Me Linh Commune

According to the growers' pest control cost them 1,100,000 Dong/sao/year, this is approximately 30,000,000 Dong/ha /year. According to the estimation of the growers this is about 60% of the total costs for the production (including fertilizer, paper for covering the roses and the plant costs but not including hired labor). Growers find it difficult to estimate the total cost for hired labor.

The cost for a general spray is 30,000 Dong/per application/sao. Normally once a month a weed control will be done by spraying a herbicide. This costs 10,000 Dong/time/sao. Costs for manual weed control amounts 30.000 Dong /person/day. Two man-days are required for every time.

5.4.2.7.2 Sapa

Sapa rose growers invest around 40,000,000 dong/ha/year in pesticides. This represents about 24% of the total production cost (120,000,000 dong/ha/year in fertilizers, pesticides, petrol, hired labors, and an added cost of 6.000.000 each year for the amortization of the plants). The growers hire 6 people for working on 1 ha /year.

Most growers in Sapa get their pesticides from Me Linh Commune. Five different shop keepers of Me Linh Commune and one shop keeper of Sapa (the only private shop in Sapa since 3 months) were asked to fill out a questionnaire. Table 5.10 gives an overview of the prices the shop keepers are asking for their pesticide products.

The shop sellers of Me Linh Commune explained that they all have their own area in the Commune to sell their products. From table 5.10 it can be concluded that different shop sellers ask different prices for the same product. Since growers will go to their 'own' shop they spend different amount of money on their pesticides.

Table 5.10 Prices of pesticides in Sapa (1 shop) and Me Linh Commune (5 shops)

Brand	*Price of the product (VND/mL)*				
	Sapa	*Me Linh*			
		(1)	(2)	(3)	(4)	(5)
Tap ky		1050	-	-	550	160
Sokupi	284	1200	625	1200	260	-
Score	804	700	720	720	700	700
Mancozeb		45,000/kg	47,000/kg	45,000/kg	47,000/kg	46,000/kg
Sherpa		150	160	150	160	-
Anvil	250/g	150	-	150	-	-
Mire Tox		150/g	75/g	160/g	-	75/g
Cyperkill		54	54	-	-	-
Bumper	385	390	390	-	380	-
Tilt	650	600	430 - 600	420	420	350-430
Forthane			45,000/kg		45,000/kg	46/g
Daconil	200,000/kg		190,000/kg			
Sec Saigon			66.67-200/mL	50/mL		
Tri Tau			70/g			
Di het			300/g		150 /g	100/g
So Ka			240/mL			
TiLt supo				1100/mL		
Ofatox					177/mL	
Lannate	277/g				240/g	550/ml
Ben cut						24/g
Alliette	32/g					

Shop keepers: (1): Nguyen Nhan Doan (not selling to sapa); (2): Nguyen Thi Du (not selling to sapa); (3): Le Thi Oanh (not selling to sapa); (4): Nguyen Van Bay (5% for sapa); (5): Tran Van Binh (not selling to sapa).

5.5 Estimated environmental and human health impact of rose cultivation

5.5.1 Label of products

5.5.1.1 Me Linh

The pesticide label provides information on health and environmental issues. For example the following text can be found on a label: ‘Keep away from children’ or ‘do not use when it is going to rain’.

Growers in Me Linh Commune were asked to explain how they read the label. One woman explained that she is never reading the label of a product, other growers know a lot about the information on the label, and they told to check the following things:

- The name of the product and the name of the producer and distributor. The name of product and the producer (logo) help them to distinguish the real from the fake ones. This information gives them confidence in the product although they can never be sure.
- the purpose of the product (this information helps producer to choose the appropriate product for the pest/disease present in their fields),
- the expiration date of the product,

- The dosage; the dose is indicative for them. On the label there is a minimum and a maximum dose. They adjust the dose to the severity of the infection, but they never use more than the indicated maximum.
- The toxicity. There are several bars on the label with different colors that indicates toxicity. The pesticides are ranged according to toxicity level: the label is colored red, yellow and blue. Blue labeled products (less harmful) are used by the growers for prevention. The growers are not satisfied about the efficiency of these products. Red labeled (most harmful) products are used to cure severe pests or infections. The growers use these red labeled pesticides rarely.

Poster hanging in the pesticide shop with an explanation of the symbols on the labels

The symbols on the labels are not read by the growers. They know these symbols are related to the impact on the environment and human health. They believe they already know how to protect themselves. They are convinced that protection is their own responsibility.

5.5.1.2 Sapa

The growers get information from the pesticide label. They only read the 'dose' on the label. Other information mentioned on the label is not interesting for them. Based on the label they decide which dose to use; this depends on how serious the pest/disease is. They never use more than the maximum volume which is advised on the label. If there is a little problem they use the minimum dose, if they have serious problems they will use the

maximum dose. The growers interviewed don't know about the toxic level of pesticide (red, yellow and blue) on the label. They also do not care about the symbols on the label.

5.5.2 Environment

5.5.2.1 General

5.5.2.1.1 Me Linh Commune

Since 2000, according to the growers and the pesticide trailers pesticide use has increased significantly (they all agreed at the feedback meeting). They blame this increase to the rose production since they consider that rose cultivation requires more pesticides than producing vegetables or rice.

The frequency of pesticide application is double and the volume of pesticides has been 2 times higher compared to 2000. It is the impression of the growers interviewed that the number of plagues has increased with the roses. Also, it is observed that many amphibian animals like frogs and fish, crab and shrimps have greatly reduced in number since 1996. Growers know this because in the past it was very easy to collect food for the meal. Last years it is much more difficult to collect these kinds of animals.

The growers relate the decrease of the amount of species to pesticide use. The relation between the mentioned environmental problems and pesticide use reported here is purely the perception of the growers. This does not mean that there is a proven cause-effect relation between the mentioned problems and pesticide use.

5.5.2.1.2 Sapa

Individual growers
According to the growers, until now there are no problems with the environment.

ATI
According to the manager pesticide use does not cause side effects to the environment.

5.5.2.2 Domestic water sources

5.5.2.2.1 Me Linh Commune

By spraying pesticides in the field direct exposure of pesticides to the surface water might take place (see risk for aquatic organisms, paragraph 5.6.3). Pesticides also might leach to the groundwater (see 5.6.5). Irrigation water is collected both from drilled well and from surface water. The drilled well is between 18 and 30 m deep. Water is supplied to fields by flooding the ditches. Drinking water is collected from the drilled well.

Irrigation system: pumping up groundwater

5.5.2.2.2 Sapa

Individual growers

They use water from the mountain for doing agricultural activities (spraying pesticide and irrigation) and drinking. The interviewed producer built a big tank to get the water from the mountain and made a system to run the water from the tank to the farm.

Some growers use the same water system; others use water directly from the stream. The producer's down stream get polluted water from the growers up stream. This causes problems; they already spoke with the district officer but until now there is no solution for this problem.

ATI

Water used by the company for drinking and irrigation purposes comes from the water supply company. The water does not come from wells nor surface water.

5.5.2.3 Disposal

5.5.2.3.1 Me Linh Commune

Growers were asked what they do with the diluted left-over's in the tank. The diluted left-overs in the spraying tank will never be brought back home, but will be or sprayed till finished or dumped in the field. When it starts raining, growers dump the left over and run away leaving it all behind.

During the transect walks lots of empty pesticide bottles and packages were found spread all over the fields. Growers do not collect this waste

To avoid runoff, growers avoid spraying just before or during rain, and waiting three hours after the rain to spray again to allow the crop to dry. Not spraying during rain is done because of efficiency reasons not because of environmental reasons.

5.5.2.3.2 Sapa

Individual growers and ATI
The pesticide leftover in the tank is used until finishing (they spray again). If they can not spray again because it rains, they will keep it in the tank for next use. Normally they spray again directly after it stops raining

5.5.2.4 Cleaning and maintenance of equipment

5.5.2.4.1 Me Linh Commune

Spraying machines are cleaned with both surface water and drilled well water. After cleaning the washing water is then disposed in the canals and/or the field. The spraying machine is brought to producer's house and is dried. The nozzles are not replaced unless they are broken. According to the growers, this can take a maximum of four years! (Size and maintenance of the nozzles is crucial in spraying technique, see also 5.3.1. *Note of the authors.*.) Except for cleaning the tank into the field, there is no other maintenance done to the spraying equipment.

5.5.2.4.2 Sapa

The sprayers clean the pesticide equipments on the field and flush the washing water on the rose beds.

5.5.3 Human health

5.5.3.1 Protective clothes

5.5.3.1.1 Me Linh Commune

During a semi structured interview the growers were asked what protective clothing they wear while spraying pesticides.

Protective clothes are bought at a general shop, not at pesticide shops. Growers renew them when they are torn apart. Masks are usually made out of textile (cotton) and are renewed after a use of +/- 3 times, or when the elastic breaks.

The group showed quite some diversity in the way they use the available protective devices (see table 5.11). For instance, women will always wear boots, but men do not when the fields are dry. Protective glasses or masks are not very common. A producer indicated to replace hat and glasses by using a motorcycle helmet!!! Raincoats are not often used when it is hot in the field.

When asked why they do not use always protection, growers indicate they are sometimes too busy, sometimes the amount is too small, sometimes it is too hot,

sometimes the fields are dry and wearing boots is not necessary for the man and finally they rely on the quality of their tank (that it is not leaching on their body). A rumor was told that a young man was spraying without clothes above his middle and in shorts. After 2 months he got very sick.

During the feedback meeting the head of the extension office of the Me Linh district told that a survey on this issue was done in 2002. Three persons of his office did a survey during 2 weeks in the fields and visited 200 growers. The results of this survey and the results of the SSI with the growers are presented in table 5.11.

Table 5.11 Percentage of growers using the following personal protection items

Protection item	*Protection (%)* *SSI growers N=8*	*Protection (%)* *Survey N=200*	*when*
Mask (cotton)	100	80	Always when spraying
(rain) coat	100	100	Some not in summer
Boots	100	100 (since 5 years)	Ladies (2) always, some of the man do not if the field is dry
Gloves	25	50	sometimes
Glasses	100	70 (women), 50 (man)	sometimes
Hat	88	80	always (one growers uses a motor helmet)

During the transect walk a producer was spraying pesticides in the field. His protection outfit included a pair of boots, a rain jacket and a cotton mask. He did not wear gloves. He was using a machine power knapsack sprayer on his back. He walked following the wind to protect himself for the pesticides. On the way back there was a producer spraying on empty beds in a just-plowed field, being irrigated. The ditches were therefore full of water and the man had to walk through the water. He wore no shoes, no protection whatsoever. Even the interviewed producer group was shocked and discussed with the man about what he was doing.

Man spraying a herbicide on the just-plowed fields

5.5.3.1.2 Sapa

Individual growers

Only one producer was interviewed on this type in Sapa. This producer has 5 workers who all spray pesticides. The following protection equipments are used when spraying pesticide, see table 5.12.

Table 5.12 Number of growers (n=1) using the following personal protection items

Protection item	*Protection (%)*	*When*
	SSI growers	
Mask (cotton)	100	Always when spraying
(rain) coat	100	Always
Boots	100	Always
Gloves	100	Always
Glasses	?	rarely
Hat	100	Always

The interviewed producer provides the protection equipments for the workers. He provides new ones when the old ones are torn apart.

After spraying pesticides all workers wash their hands and sometimes they take a bath; sometimes they do other things immediately afterwards. In this case they do not take a shower. They usually mix 3 types of pesticide. They put all pesticides in the tank and put water in it to mix them together.

ATI

The manager of the company explained that ATI has some rules regarding the protection of its employees; everybody has to wear full protection. 3 times a year the company gives protective clothing to the workers. They are using the standard mask. While walking though the field it was observed that the workers really wore all the protective clothing.

5.5.3.2 Side effects of pesticides

5.5.3.2.1 Me Linh Commune

The growers were asked to mention health problems and its possible relation with pesticide use. They indicate that the direct side effects of pesticides like headache, red skin and feeling of a burned skin, were larger in the past. The growers agreed that the old pesticides gave more problems. Nevertheless they indicate that there are some direct effects. Symptoms they have experienced themselves are:

- When pesticide accidentally drops on skin, growers will get burn skin or red spots on skin. This happens quite often, especially when growers do not wear protective clothing such as rain jacket and gloves and when growers use manual spray equipment called knapsack. When they get affected, some growers use soap or a mixture of soap and salt as treatment for one day. They said the problem is gone after one day. 7 out of 8 respondents have had this problem.
- Headache: happens to those who have flu already before spraying. Treatment that they find is Lemon juice with ice. Some use medicine.
- Dizzy: happens to those who do not wear mask or while working in the sun. Treatment includes drinking ice lemon juice and relaxing.

The interviewed growers do not experience any serious symptoms themselves, but they know this from other growers.

It was mentioned that new diseases have increased in the last years; cancer, skin diseases, infertility. They attribute this increase to the increase in the use of pesticides since the growers focus on roses. The relation between the mentioned health problems and pesticide use reported here is purely the perception of the growers. This does not mean that there is a proven cause-effect relation between the mentioned problems and pesticide use.

Producer's measures:

To the question what they can do to avoid hazard to their and other people's health, growers agree in trying to limit the use of 'red labeled pesticides' as much as possible.

They are concerned about the fact that there is always somebody spraying and therefore they propose a system of simultaneous spraying. Unfortunately, there was no chance to discuss this point in depth, because from our expert point of view, this is not an appropriate solution.

They are aware that it will be very difficult to reduce pesticide use, because it depends on individuals. They feel the creation of plant protection team that has influence on the growers will help.

5.5.3.2.2 Sapa

Individual growers

According to the interviewed producer the pesticides affect the human health and the environment. The growers have headache after using pesticide and sometimes if they spray pesticides on the field the people in their family also have headache (because the field is near to the houses). Besides headache they do not have any other problems with their health. They do not have skin problems. Regarding the effect of pesticides to the environment they can not give any real indication. In their opinion, it is not a real problem for Sapa currently.

ATI

According to the manager there are no side effects for the workers.

5.5.3.3 Storage of pesticides

5.5.3.3.1 Me Linh Commune

Growers were asked where they store their pesticides. In the interviewed group everybody affirms to have a room to store the pesticides: this does not mean that this room is always a suitable place. Sometimes the room is in the house, sometimes it is in the back of the house. In this case, the whole house must be crossed with the chemicals and spraying machine. Also it is sometimes stored somewhere in the garden, next to the gate, etc. In the room other things are stored, like spraying equipment, gardening tools, bicycles, etc.

Fresh, unbroken packages and bottles are usually not stored longer than a week; there is no need for storage since the shops always have the products available in stock. Sometimes they buy the chemicals even on the way to the field for immediate use. Open packages are sealed and put in a tight plastic bag and placed or hang high in the room till the next use.

During the Transect walk one producer showed the place where the pesticides were kept: this turned out to be the kitchen, close to the stove.

Spraying tank hanging close by the kitchen

5.5.3.3.2 Sapa

Individual growers

The pesticides are put in carton boxes and stored in special room (next to the house) with other planting equipments. The pesticide leftover (of the packages) are put in a plastic bag and the are closed and stored in the same place with new one.

ATI

ATI has a special place to storage pesticides, 6 km from the farm. The pesticides come from Hanoi (3 times a week a truck is going to Hanoi and comes back) and put in the

storage place. They bring just a little bit into the fields for daily or weekly use. The company collects the waste and once a year it is brought to the regional waste processing company. There is no waste in the fields; this is a big difference with the normal farms in Me Linh and Sapa which are managed by one producer. This difference is partly explained by the fact that the ATI rose production site visited is also an eco tourism destination. At different places in the field the company built cabins where tourists stay overnight.

5.6 Hazard of pesticide use

5.6.1 Introduction

A *hazard assessment* is done based on the observations and data provided during the field work and using four different hazard indicators (WHO hazard class, leaching potential, and terrestrial and aquatic toxicity index). Hazard estimations are made for crop management practices currently applied by growers in the research area. Hazard estimations are based on pesticide parameters solely and do not take into account site specific aspects, such as climate, soil type and application practices. Therefore hazard estimations give a relative ranking of the hazards associated with pesticide use patterns. A hazard assessment can be performed in many different ways. In this study four different types of hazards are considered: occupational hazard to human health, hazard to terrestrial and aquatic life, and hazard to groundwater pollution. For each type of hazard a hazard indicator is selected.

5.6.2 Hazard to human health using the WHO classification

The *WHO Classification by hazard* is used to classify pesticides according to the acute risk to health that might be encountered accidentally by a person handling the product in accordance with the directions for handling by the manufacturer. The classification distinguishes between the more and the less hazardous forms of each pesticide in that it is based on the toxicity of the chemical compound and on its formulation. Therefore, allowance is made for the lesser hazards from solids as compared to liquids. The classification is primarily based on the acute oral and dermal toxicity to the rat. Provision is made for the classification of a particular compound to be adjusted if, for any reason, the acute hazard to man differs from that indicated by the LD_{50} assessments alone (WHO, 2004).

Table 5.13 WHO classification

LD50 for the rat (mg/kg body weight)					
		Oral		Dermal	
		Solids a)	Liquids[a]	Solids a)	Liquids a)
Ia	Extremely hazardous	5 or less	20 or less	10 or less	40 or less
Ib	Highly hazardous	5-50	20 - 200	10 - 100	40 - 400
II	Moderately hazardous	50-500	200 - 2000	100 - 1000	400 - 4000
III	Slightly hazardous	Over 500	Over 2000	Over 1000	Over 4000

a) The terms ‘solids’ and ‘liquids’ refer to the physical state of the active ingredient being classified.

Both areas are dependent on the pesticides from the shops in the Me Linh Commune. In the Me Linh Commune an inventory was done at the pesticide shops. According to the growers 14 pesticides were mentioned which will be used for the rose production; according to the shop keepers another 8 pesticides are also used by the growers for the rose production. In figure 5.3 these results are not included (only the mentioned pesticides by the growers are included in the figure).

Methomyl (ranked as highly hazardous) is used in both areas. No other extremely or highly hazardous active ingredients were used. In Me Linh 42 % and in Sapa 29 % of the active ingredients of the pesticides ranked as highly or moderately hazardous (Figure 5.3).

In both areas the most frequently used moderately hazardous Active Ingredients were propiconazole and cypermethrin. In Me Linh Commune also imidacloprid was used. Annex I gives an overview of the different pesticides, active ingredients and the WHO class to which the active ingredient belongs.

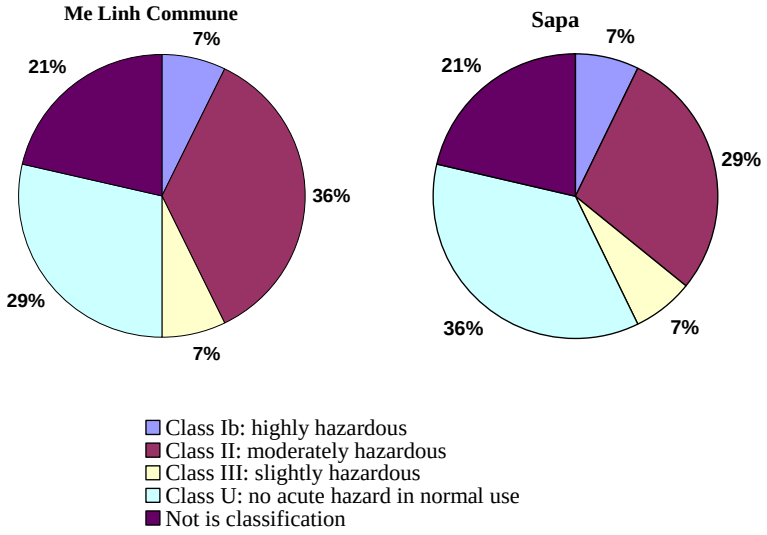


Figure 5.3 Classification of the used pesticides according the to WHO hazard classification

5.6.3 Hazard to aquatic life using the Aquatic Toxicity Indicator

The *Aquatic Toxicity Index* (ATI) is used to classify the pesticides according to their acute hazard to aquatic life. Dissipation rate in water is not taken into account.

Narrative descriptions of toxicity were assigned based on the LC_{50} of the most sensitive standard species (fish, daphnia or algae) according to the guidelines in M. A. Kamrin, *Pesticide Profiles: Toxicity, Environmental Impact, and Fate,* Lewis Publishers (Boca Raton, FL, 1997), p. 8 (see table 5.14). These criteria are also used by the Pesticide Action Network (PAN) and are similar with the criteria descript in the Manual for

summarizing and evaluating the environmental aspects of pesticides (RIVM, report no. 679101022)

Table 5.14 Relation between the LC_{50} and the Aquatic Toxicity Indicator

LC_{50} (ug/L)	*Aquatic Toxicity Index*
< 100	Very highly toxic
100 - 1,000	Highly toxic
1,000 - 10,000	Moderately toxic
10,000 - 100,000	Slightly toxic
>100,000	Practiacally nontoxic

In both regions at least 50% of the pesticides pose a very high hazard for aquatic life. Pesticides with diazinon, cypermethrin, imidacloprid, mancozeb, methomyl, propiconazole and propineb are very highly toxic for the aquatic organisms.

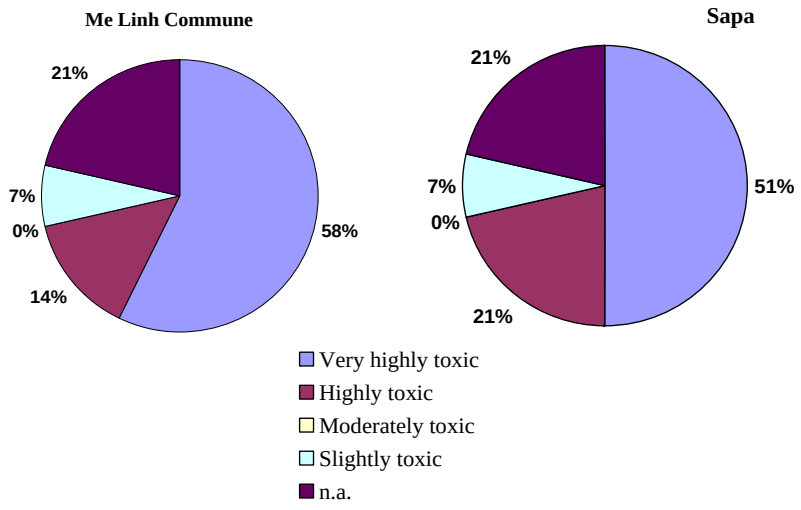


Figure 5.4 Classification of the used pesticides according to the Aquatic Toxicity Index

The potential risk for the aquatic organisms is also dependent on the persistence of the active ingredient in the water phase. Extra care should be taken if a pesticide is very toxic for aquatic organisms and if the degradation rate in water is low. In table 5.15 an overview is given of all pesticides, their Aquatic toxicity index and the DT_{50} in the water phase.

Table 5.15 Overview of Pesticides, A.I, the A.T.I and the DT50 in the water phase

Pesticide	*A.I.*	*Me Linh*	*Sapa*	*Aquatic Toxicity Index*	*DT_{50} water phase (d)*
Mancozeb 80 WP	mancozeb	X	X	Very highly toxic	0.2
Forthane 80WP	mancozeb	X	X	Very highly toxic	0.2
Score 250 EC	difenconazole	X	X	Highly toxic	n.a.
Bumper 250 EC	propiconazole	X	X	Very highly toxic	57
Sokupi 0.36 AS	Matrine	X	X	n.a.	n.a.
Tri Tau	?	X	X	n.a.	n.a.
Lanate 40 SP	methomyl	X	X	Very highly toxic	4
Sec Saigon 50 EC	cypermethrin	X	X	Very highly toxic	3
Tap ky 1.8 EC	abamectin	X	X	Slightly toxic	149
Tilt 250 EC	propiconazole	X	X	Very highly toxic	57
Daconil 500 SC	chlorotalonil	X	X	Highly toxic	1.6
Visher 25 ND	cypermethrin	X		Very highly toxic	3
Antracol	Propineb 700 g/kg	X	X	Very highly toxic	<<
Mire Tox 10WP	imidacloprid	X		Very highly toxic	73
Alliette 800 WG	Fosetyl aluminium		X	Highly toxic	n.a.
Bazudin	Diazinon		X	Very highly toxic	n.a.

Table 5.15 shows that propiconazole and imidacloprid are very highly toxic for aquatic organisms and have a DT_{50} of respectively 57 days and 73 days.

5.6.4 Hazard to aquatic life using the Terrestrial Toxicity Indicator

The *Terrestrial Toxicity Index* (TTI) is used to classify the pesticides according to their acute hazard to terrestrial life. Dissipation rate in soil is not taken into account.

Narrative descriptions of toxicity were assigned based on the LC_{50} of the earthworms. Toxicity values of terrestrial plants and soil micro-organisms are not taken into account. The criteria are according to the Manual for summarizing and evaluating the environmental aspects of pesticides (RIVM, report no. 679101022).

Table 5.16 Relation between the LC_{50} and the Terrestrial Toxicity Indicator

LC_{50} (mg/kg dry soil)	*Terrestrial Toxicity Index*
< 1	Highly toxic
1 - 10	Toxic
10 - 100	Moderately toxic
100 - 1.000	Slightly toxic
> 1.000	Very slightly toxic

Pesticides with imidacloprid, propiconazole and abamectine are highly toxic. In Me Linh Commune 30 % of the pesticides pose a high hazard for terrestrial life. The same pesticides are used in Sapa with an exception for imidacloprid which is not used in Sapa.

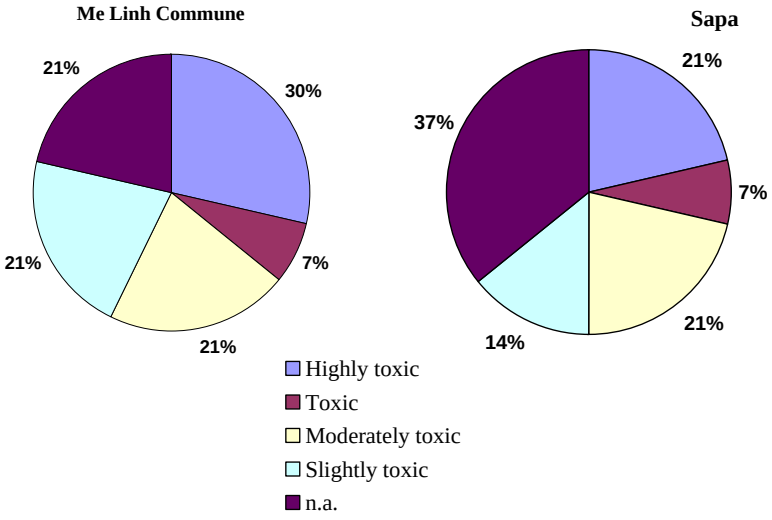


Figure 5.5 Classification of the used pesticides according to the Terrestrial Toxicity Index

The potential risk for the terrestrial organisms is also dependent on the persistence of the active ingredient in soil. Extra care should be taken if a pesticide is very toxic for organisms and if the degradation rate in soil is low. In table 5.17 an overview is given of all pesticides, their Terrestrial toxicity index and the DT_{50} in soil.

Table 5.17 shows that abamectine and imidacloprid are highly toxic for terrestrial organisms and have a DT_{50} of respectively 100 and 114 days.

Table 5.17 Overview of Pesticides, A.I, the A.T.I and the DT50 in the water phase

Pesticide	*A.I.*	*Me Linh*	*Sapa*	*Terrestrial Toxicity Index*	*DT_{50} soil (d)*
Mancozeb 80 WP	mancozeb	X	X	Moderately toxic	0.15
Forthane 80WP	mancozeb	X	X	Moderately toxic	0.15
Score 250 EC	difenconazole	X	X	N.a.	-
Bumper 250 EC	propiconazole	X	X	Highly toxic	45
Sokupi 0.36 AS	Matrine	X	X	n.a.	-
Tri Tau	?	X	X	n.a.	-
Lanate 40 SP	methomyl	X	X	toxic	11
Sec Saigon 50 EC	cypermethrin	X	X	Slightly toxic	59
Tap ky 1.8 EC	abamectin	X	X	Highly toxic	100
Tilt 250 EC	propiconazole	X	X	Highly toxic	45
Daconil 500 SC	chlorotalonil	X	X	Moderately toxic	9
Visher 25 ND	cypermethrin	X		Slightly toxic	59
Antracol	Propineb 700 g/kg	X	X	Slightly toxic	0.08
Mire Tox 10WP	imidacloprid	X		Highly toxic	114
Aliette 800 WG	Fosetyl aluminium		X	n.a.	n.a.
Bazudin	Diazinon		X	n.a.	n.a.

5.6.5 Hazard to groundwater using the GUS index

The *GUS or Groundwater Ubiquity Score* (Wauchope et al., 1992) is used to rank pesticides for their potential to move towards groundwater. GUS is an empirically derived value that relates pesticide persistence (half-life) and sorption in soil (sorption coefficient, K_{oc}). The GUS index is calculated as follows

$$GUS = \log\ (DT_{50}) \times [4 - \log (K_{oc})]$$

The pesticide movement rating is derived from the GUS. Movement ratings range from extremely low to very high. The GUS should be interpreted as indicated in Table 5.18.

Table 5.18 Relation between the GUS index and the potential to move to groundwater

GUS	*Potential to move to groundwater*
<1	Very low
1.0-2.0	Low
2.0-3.0	Moderate
3.0-4.0	High
>4.0	Very high

The soil half-life (Degradation Time 50%: $DT_{50,soil}$) is a measure of the persistence of a pesticide in soil. Pesticides can be categorized on the basis of their half-life as readily degradable, degrading to half the original concentration in less than 20 days; fairly degradable, degrading to half the original concentration in 20 to 60 days; persistent/slightly degradable, degrading to half the original concentration in 60 to 180 days; very persistent/slightly degradable, taking longer than 180 days to degrade to half the original concentration. A 'typical soil half-life' value is an approximation and may vary greatly because persistence is dependent on variations in site, soil, and climate. Figure 5.6 shows the persistence in soil of the Active ingredients used in Me Linh Commune and Sapa.

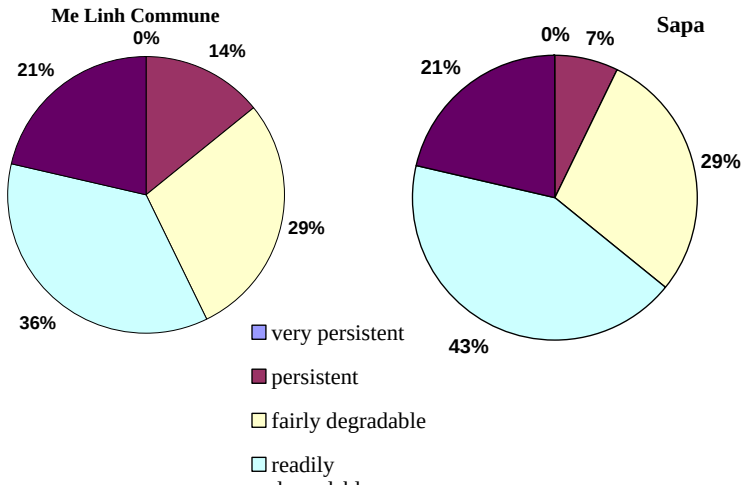


Figure 5.6 Classification of the used pesticides based on persistence in soil

The DT_{50} values used for the classification of the used pesticides based on persistence in soil and the calculations of the GUS leaching index are standardized to a temperature of 25ºC. The sorption coefficient (K_{oc}) describes the tendency of a pesticide to bind to soil particles. Sorption retards movement and may also increase persistence because the pesticide is protected from degradation. The higher the K_{oc}, the greater the sorption potential. K_{oc} is derived from laboratory data. Many soil and pesticide factors may influence the actual sorption of a pesticide to soil.

The half-lives and sorption coefficients used in the study are presented in Appendix 2.

The following figure shows the classification of the used pesticides using the GUS leaching index.

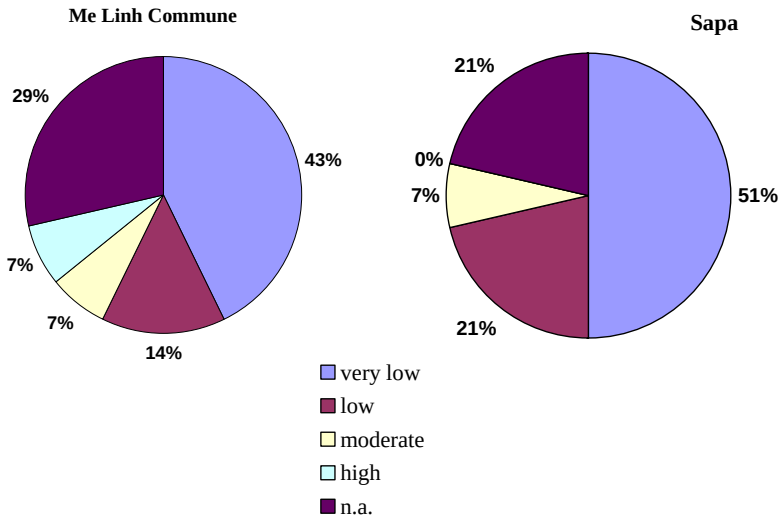


Figure 5.7 Classification of the used pesticides using the GUS leaching index

In Me Linh, the active ingredient imidacloprid of the pesticide Mire Tox pose a high hazard to groundwater. Methomyl pose a moderate hazard to groundwater for both areas: Me Linh Commune and Sapa. All other pesticides do have a low or very low potential to move towards groundwater.

5.6.6 Overall results

Table 5.19 gives an overview of the pesticides with a potential high hazard.

5.6.6.1 Assessment of hazards to human health

If growers use formulations with hazardous active ingredients that are listed by the WHO classification it poses a potential risk to their health. In Me Linh and Sapa the pesticide Lanate 40 SP contains the active ingredient methomyl which is ranked as highly hazardous. The active ingredients Propiconazole and cypermethrin are ranked as moderately hazardous. In Me Linh Commune also imidacloprid is used which is ranked as moderately hazardous was used. Safe use training with special attention for these pesticides is a suitable intervention.

Table 5.19 Active Ingredients, formulations and potential high hazard

AI	Class	Formulations	Area	
			Me Linh	Sapa
Potential high hazard to humans (using WHO Classification)				
Methomyl	High	Lanate 40 SP	X	X
Cypermethrin	Moderate	Sec Saigon 50 EC	X	X
		Visher 25 ND	X	-
Propiconazole	Moderate	Bumper 250 EC	X	X
		Tilt 250 EC	X	X
Imidacloprid	Moderate	Mire tox 10 WP	X	-
Diazinon	Moderate	Bazudin	-	X
Potential high hazard to aquatic life (using ATI)				
Diazinon	Very highly toxic	Bazudin	-	X
Cypermethrin	Very highly toxic	Sec Saigon 50 EC	X	X
		Visher 25 ND	X	-
Imidacloprid	Very highly toxic, persistence in water	Mire tox 10 WP	X	-
Mancozeb	Very highly toxic	Mancozeb 80 WP	X	X
		Forthane 80 WP	X	X
Methomyl	Very highly toxic	Lanate 40 SP	X	X
Propiconazole	Very highly toxic, persistence in water	Bumper 250 EC	X	X
		Tilt 250 EC	X	X
Propineb	Very highly toxic	Antracol	X	X
Potential high hazard to terrestrial life (using TTI)				
Abamectine	Highly toxic	Tap ky 1.8 EC	X	X
Imidacloprid	Highly toxic	Mire tox 10 WP	X	-
Propiconazole	Highly toxic	Bumper 250 EC	X	X
		Tilt 250 EC	X	X
Potential high hazard to groundwater (using GUS index)				
Imidacloprid	High	Mire tox 10 WP	X	-
Methomyl	Moderate	Lanate 40 SP	X	X

5.6.6.2 Assessment of hazards to aquatic life

The assessment ranks pesticides according to toxicity to aquatic life (with Fish, Daphnia magna and algae as its representative). The hazard assessment will relate high hazards to high toxic compounds. It does not take into account the dissipation rate of the compound. Highly toxic compounds with high dissipation rate can pose a lower risk to aquatic life than persistent compounds with lower toxicity. The risk of judging pesticides on the basis of toxicity only is that growers are stimulated to use compounds with lower toxicity that could persist in the environment for a long time and pose risks to downstream areas. Whether high toxicity will result in a real risk to aquatic life in the analysed area depends on the quantities applied, the presence and distance to surface water bodies, the vulnerability of the ecosystem, etc. These factors are not taken into account in this report.

Therefore this assessment can only be used to decide whether follow-up risk assessments are required and for which situations (formulations, physical conditions). Real risks are expected in situations were highly hazardous compounds are used in areas near

valuable surface water bodies. A surface water body can be valuable from an ecological point of view or because the water is used for domestic purposes.

In Me Linh Commune and Sapa further risk assessments should be focused on formulations containing diazinon, propineb, cypermethrin, imidacloprid, mancozeb, methomyl, and propiconazole applied to roses. Special attention is needed for the active ingredients imidacloprid and propiconazole because these substances are persistent in water! Also attention is needed for the active ingredient mancozeb because of the total amount of 28.6 kg active ingredient per hectare; mancozeb is responsible for 26.8 kg! There is a potential risk for the aquatic ecosystem and therefore further risk assessment taking specific site aspects, such as climate and application practices into account is recommended.

5.6.6.3 Assessment of hazard to terrestrial life

The assessment ranks pesticides according to toxicity to terrestrial life (with earthworms as its representative). The hazard assessment will relate high hazards to high toxic compounds. It does not take into account the dissipation rate of the compound. Highly toxic compounds with high dissipation rate can pose a lower risk to terrestrial life than persistent compounds with lower toxicity. The risk of judging pesticides on the basis of toxicity only is that growers are stimulated to use compounds with lower toxicity. Whether high toxicity will result in a real risk to terrestrial life in the research area depends on the quantities applied, the presence and distance to surface water bodies, the vulnerability of the ecosystem, etc. These factors are not taken into account in this report.

Therefore this assessment can only be used to decide whether follow-up risk assessments are required and for which situations (formulations, physical conditions). Real risks are expected in situations were highly hazardous compounds are used in areas near valuable surface water bodies.

In Me Linh Commune and Sapa the focus of further risk assessments should be on formulations containing abamectine, imidacloprid, and propiconazole applied to roses. Special attention is needed for the active ingredients imidacloprid and abamectine since these substances are persistent in soil (DT_{50} > 90 d)!

There is a potential risk for the terrestrial ecosystem and therefore further risk assessment taking specific site aspects, such as climate, soil type and application practices into account is recommended.

5.6.6.4 Assessment of hazard to groundwater

The assessment of hazard to groundwater takes into account mobility and dissipation in soil, but not toxicity. Therefore low mobile compounds with quick dissipation rates will rank lower than high mobile compounds with slow dissipation rates. It provides an indication whether the compound is likely to reach groundwater before it is degraded. Whether it is a risk to groundwater depends on the toxicity of compound and the use of the groundwater. Therefore, also for this assessment, it needs to be realized that the occurrence

of real risks is only expected where toxic compounds with high hazard indication are used in vulnerable scenarios. Areas with (a combination of) low groundwater tables, high rainfall, sandy soils with low organic matter are vulnerable to pesticide leaching.

The assessments can be used to target further risk assessments. In Me Linh Commune and Sapa the focus should be on formulations containing methomyl. In Me Linh Commune the focus should also be on the formulations containing imidacloprid.

There is a potential health risk through the consumption of groundwater and therefore further assessment of the risks of leaching of pesticides to groundwater is recommended.

6. Pesticide control mechanism

6.1 Introduction

Three experts were interviewed on pesticide control mechanisms. These interviews took placing using the SSI method. In this chapter the most important findings of these interviews are presented.

1). Dr. Dao Trong Anh, Plant Protection Department (1).
Dr. Dao Trong Ahn is the chief of the pesticide management & registration division of the Plant Protection Department (PPD), a department of the Ministry of Agriculture and Rural Development (MARD).

PPD
In Hanoi, 500 employees are working at PPD head office. The three main duties of PPD are:
1. Plant protection service; advise growers how to recognize pests and diseases in the fields and which pesticide to use. Train growers directly and trough training to the sub-district departments.
2. Plant Quarantine.
3. Pesticide management & registration Division

All 64 sub-districts of Vietnam have their own sub-district department with +/- 50 employees. Every sub-district department has a pesticide management team.

Pesticide management & registration Division
In Hanoi this division consists of six persons in total.
The main tasks of this division are:
- regulation on the use of pesticides;
- regulation on the production of pesticides;
- labeling of products (pesticides);
- Registration of pesticides.

Besides these main tasks, the division organizes 4 to 6 times a year (sometimes more) seminars, courses or conferences for the sub-district departments. They explain about the regulation or new pesticides which already exist in other countries.

If they have too much dossier work they sometimes get help from the other divisions/departments or from the university and institutes.

2). Dr. Dao Xuan Cuong, Syngenta (2).
Dr. Dao Xuan Cuong is the Technical Director of Syngenta.

Syngenta
The main office of Syngenta is in Switzerland. Since 2001 Syngenta also operates in Vietnam, with a total staff of about 120 employees. The head office is 30 km from Ho Chi Min City. Syngenta Vietnam is focusing on repacking of the imported products (the volume of the packages are very small). Syngenta Vietnam does not focus on producing of products and therefore there is no factory.

Syngenta is starting with a new project: Program Steward Ship.
This program will focus on:
- safe and effective product use
- Personal protection and safety equipment for the growers.

One example of the program is as follows: A lot of waste is spread all over the fields. Syngenta wanted to do something about this. In three villages they (started to) build an incinerator to burn waste. Some workers are hired to collect the packages and the waste.

Dr. Doa Xuan Cuong was asked to give an overview of the main pesticide producing companies in Vietnam. He gave the following list:
1. Syngenta
2. Bayer
3. Dow
4. BASF
5. Dupont
6. Arita (Japan)
7. Monsanto

And 100 small Vietnamese companies. 36 of them work together in an association.

3). Pham Van Hoi, PhD student of the Environmental Policy Group, WUR (3).
Pham Van Hoi is a PhD student of the Wageningen University and Research Centre. He is working at the Environmental Policy Group.

6.2. Environmental legislation,

6.2.1 General registration scheme

Before 1990 no legislation on pesticide use existed in Vietnam. The current law is very new and Vietnam learns from neighboring countries like China, Japan, Malaysia and others. Since 1990 there is a registration scheme and there are lists available with pesticides that are allowed to use, pesticides that can be used with restrictions and banned pesticides (Dr. Dao Trong Anh). Two times a year MARD announces a list of pesticides registered in Vietnam. The first public announcement is in April, the second in Augustus/September. In this latter publication, just new products will be added to the list.

The growers are supposed to use only pesticides that are positively mentioned on these lists. Vietnam itself does not produce any AI. A very important criterion for

successful registration of a pesticide is if the pesticide is already registered in another country (Dr. Dao trong Anh)!

Figure 5.8 gives a general overview of the current pesticide registration procedure (official overview of PPD)

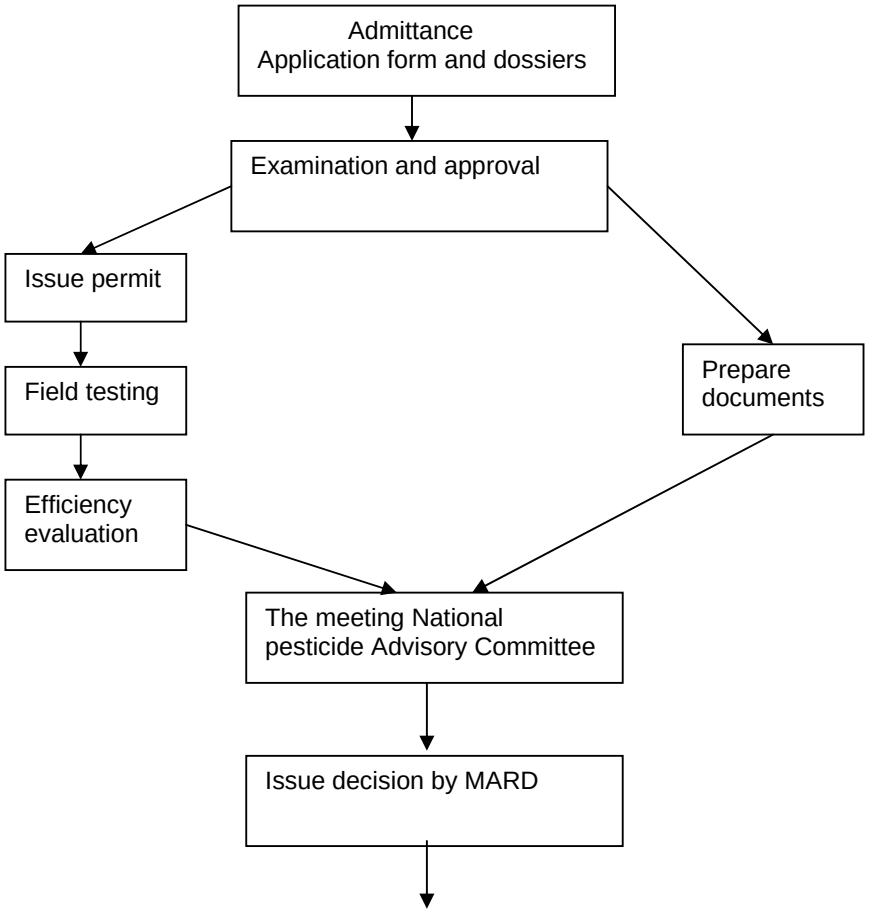


Figure 5.8 Overview of the Vietnamese PPD Pesticide Registration procedure

6.2.2 General criteria for registration

Through Dr. Dao Xuan Cuong the following information was collected:

All products have to be register before they can be used or sold in Vietnam. Some products *cannot* be registered in Vietnam, which are:

a. products or Active Ingredients registered as WHO class I
b. Chloride products

c. Toxic products (carcinogen, teratogen,…) according to WHO and FAO
An extra criteria for rice: high toxic for fish (but there is no quantitative criteria)

Only finished products are registered, active ingredients are not registered.

The question was also asked if additional Syngenta criteria (criteria for all Syngenta products) are defined by the Syngenta headquarter. Some products do follow the FAO criteria, others do not.

Another very important criterion for registering a pesticide is if the pesticide is already registered in another country; if a pesticide is not registered in another country it can not be registered in Vietnam (Dr. Dao trong Anh)!

6.2.3 Types of registration

There are 4 types of registration:

1. Full-registration, for a new product
2. Supplementary registration: for label extension for example registration for a new crop, new target organism, dose, formulation (% AI, *not* for solvent, carrier etc.), and name change (if the same name is already used by another company).
3. Re-registration: after 5 years
4. Exceptional registration: bio-product (micro-biological, nature)

Annex 4 presents a more detailed overview of the whole description of the registration procedure.

6.2.4 legislation and registration for roses

The procedure for legislation and registration for roses is the same as for other crops.

For the rose production only pesticides can be used which are registered for roses. In Vietnam the following pesticides are registered for roses (according to the lists of 2006):

Table 6.20 Pesticides which are registered for roses

Trade name	*Active ingredient*	*Pest/disease*	*Applicant*
Atamite 73 EC	Propargite	Nhen do (Red spider mite)	Limited liability company Viet thang
Binhtac 20 EC	Amitraz	Nhen do (Red spider mite)	Bailing international Co.,Ltd
Binhtox 3.8 EC	Abamectin	Nhen do (red spider mite), bo tri (thrips)	Bailing international Co.,Ltd
Detect 50 WP	Diafenthiuron	Nhen do (Red spider mite)	Incorporated company Nicotex
Dimenat 20 EC	Dimethate	Rep (Aphids)	Limited liability company $N^0$1Defend plant Sai gon
Discid 25EC	Deltamethrin	Rep (Aphids)	Limited liability company Viet thang
Fenbis 25 EC	Dimethoate 21.5% Fenvalerate 3.5%	Bo tri (Thrips)	Limited liability company $N^0$1Defend plant Sai gon
Fortaras 25 WG	Thiamethoxam	Ray nau (plant brown hopper),	Limited liability company

Trade name	*Active ingredient*	*Pest/disease*	*Applicant*
		Rep (Aphids)	Phu Nong
Hapmisu 20EC	Imidacloprid 2% Pyridaben 18%	Nhen do (Red spider mite)	Limited liability company product Hight tech
Helarat 2.5EC	Lambda Cyhalothrin	Sau khoang (Sodoptera)	Helm AG
Imitox 20SL 700WG	Imidacloprip	20SL Ray nau (plant brown hopper), 700WG: Bo tri (thrip)	Limited liability company - economic Dong xuan
Jiami 10 SL	Imidacloprip	Ray nau (plant brown hopper)	Jia Non Enterprise Co.,Ltd
Jugal 17.8 SL	Imidacloprip	Ray nau (plant brown hopper)	United Phosphorus Ltd
Map - Lono 5EC	Imidacloprip	Bo tri (thrips)	Map Pacific PTE Ltd
Map - Judo 25WP	Buprofezin	Rep (Aphids)	Map Pacific PTE Ltd
Mikhada 10WP	Imidacloprip	Ray nau (plant brown hopper)	Incorporated company Minh Khai
Mospilan 20SP	Acetamiprid	Bo tri (thrips)	Nippon Soda Co., Ltd
Nofada 105EC	Abamectin 15g/l Imidacloprip 90g/l	Ray nau (plant brown hopper)	Limited liability company - economic Nong phat
Olong 55WP	Bacillus thuringiensis va. Kurstaki (50.000 IU) 1% + Thiosultap - Sodium (Nereistoxin) 54%	Insect (Sau xanh)	Limited liability company $N^0$1Defend plant Sai gon
Penalty 40WP	Buprofezin 20% Etofenprox 20%	Ray nau (plant brown hopper), Ray trang (plant white hopper)	Limited liability company ADC
Secsaigon 50EC	Cypermethrin	Insect (Sau xanh)	Limited liability company $N^0$1 Defend plant Sai gon
Secure 10SC	Chlorfenapyr	Red spider mite, Thrips	BASF Singapore Pte Ltd
Selecron 500EC	Profenofos	Red spider mite	Syngenta Vietnam Ltd
TP-Zep 18 EC	Plant oil	Black spots, Powdery mildew	Limited liability company Thanh Phuong
Alimet 80WP	Fosetyl Aluminium	Chet cay (die plant)	Limited liability company Defend plant AN Hung Phat
Alphacol 700WP	Propineb	Powdery mildew	Limited liability company chemical Argicultute Hoa binh
Binyvil 80WP	Mancozeb 72% Fosetyl - Aluminium 8%	Vang la (yellow leaves)	Limited liability company - economic & product Ngoc yen
Dibavil 50FL, 50WP	Carbendazim	Gi sat (rust)	Limited liability company plant Agri medical Dien Ban
Mancolaxyl 72WP	Mancozeb 64% Metalaxyl 8%	Powdery mildew	United Phosphorus Ltd
Vieteam 80WP	Tricyclazole 0.5% Sunfur 79.5%	Powdery mildew	Limited liability company Defend plant Viet Trung

Bio - Origin Products

Table 6.21

Trade name	*Active ingredient*	*Pest/disease*	*Applicant*
Abapro 1.8 EC	Abamectin	Red spider mite, Thrips	Sundat (S) Pte Ltd
ABT 2WP	Abamectin 0.9% Bacillus thuringiensis 1.1%	Insect (Sau to, sau khoang, Sau duc than) Red spider mite, Third	Limited liability company Nong Sinh
Azimex 40 EC	Abamectin	Insect (Sau to, sau khoang, Sau duc than) Red spider mite, Thrips, aphids,	Asiatic Agricultural Industries Pte Ltd
Plutel 1.8EC, 3.6EC	Abamectin	Insect (Sau to, sau khoang, Sau duc than) Red spider mite, Thrips, aphids,	Guizhou CVC INC (Tong cong ty TM Zhongyue Quy chau Trung quoc)
Susupes 1.9EC	Emamectin benzoate	Red spider mites, Thrips, aphids,	Limited liability company product Hight tech
Bio - Humaxin Sen vang 6SC	Tricoderma spp 10^5CFU/ml 1% + K - Humate 5%	Fungus	Limited liability company An Hung Tuong
Bitidi WP	Bacillus subtilis 10^9 cfu/g	Powdery mildew	Limited liability company Nong sinh
Etobon 0.56SL	Cytokinin (Zeatin)	Nematodes, root spot	Limited liability company Defend plant AN Hung Phat
Dibavil 50FL, 50WP	Carbendazim	Gi sat (rus)	Limited liability company plant Agri medical Dien Ban
Mancolaxyl 72WP	Mancozeb 64% Metalaxyl 8%	Powdery mildew	United Phosphorus Ltd
Vieteam 80WP	Tricyclazole 0.5% Sunfur 79.5%	Powdery mildew	Limited liability company Defend plant Viet Trung
Fulhumaxin 5.65 SC	Trichoderma spp 10^6 CFU/ml 1% + K-Humate 3.5% Fulvate 1% Chitosan 0.05% Vitamin B_1 0.1%	Black spot, rust, Powdery mildew	Limited liability company An Hung Tuong

According to Dr. Dao Trong Anh the growers have good knowledge of flower production. They know which pesticide can control the diseases. Their choice for a pesticide must be based on the law; they have to follow the regulation. Growers know very well about this regulation since they can read it in the newspaper. The shops are not allowed to sell products for roses when these products are not registered for roses. The sub-district department is responsible for the control of legal use of pesticides. Sometimes they check the products in the shops and sometimes the check the use of pesticides in the fields.

More than 40 pesticides are official registered for roses. Only one of these pesticides, Sec Saigon, was used by the growers of Me Linh Commune and Sapa. In almost all the cases growers use pesticides which are registered for other crops; not for the production of roses. In fact they use illegal pesticides for the rose production.

It is unclear why the growers do not use the registered pesticides, especially because the registered pesticides often have the same active ingredients as the pesticides the growers use. Further research to understand this topic is recommended.

7. Market access and market constraints

7.1 Introduction

The field work allowed us to assess at a general level the current status of marketing chains between rose growers from Me Linh and Sapa and their most important final market, being Hanoi. The research team interviewed different combinations of actors related to different levels of the rose chain; small growers, managers of a larger production company and their workers, wholesalers, flower shops, flower stalls, hawkers and final consumers. The short time available limited the possibilities to survey in a systematic way the different stakeholders. But based on semi structured interviews, site visits and participatory observations useful information was collected, that helped to reconfirm and up date information already collected as part of the ProPoor Horticulture program (Quang et al, 2004).

Based on the data collected, we estimate that Me Linh marketed over 225,000,000 roses in 2005. About 50% of these are ultimately sold to consumers in Hanoi. Large farmers in Sapa produced over 3,000,000 roses in 2005. Small growers in Sapa sent the majority of their production of about 12,300,000 roses to Hanoi and Me Linh.

The largest wholesale market in Hanoi is Quang Ba whole sale market, which sells more than 70% of all whole sale roses.

7.2 Flower collection

Information about flower collection was gathered by a visit to one collectors home followed by a SSI with 7 rose collectors. The owner of the visited cold store started collecting flowers 10 years ago and started keeping them in a rented cold storage room in Hanoi 7 years ago. 3 years ago he copied the system to build his own cold storage room . All present collectors are also rose sellers and rose growers themselves. Roses are bought directly from farmers in the fields and commune markets. Beside Me Linh commune, collectors also buy roses in other areas such as Tay Tuu (Hanoi).

Criteria for them to buy flowers include:

- Big bud
- Thick and long stem
- Straight stem, without branch
- Having many leaves.
- Green, greasy leaves.
- No spots on the leaves

However, when there is less supply than demand, they are prepared to accept flowers that do not meet their quality criteria.

The presence or absence of residue in the leaves is not considered among the quality criteria, because they believe, the residue will disappear when the leaves are washed.

The flowers of different suppliers (all regular suppliers, selected because of their quality) are then mixed together to be classified into 3 categories:

- first class
  - length 50-60 cm in summer, 80-100 cm in winter
  - bud size 3 cm diameter in summer, 5 cm in winter.
- Second class (criteria not specified)
- Third class (criteria not specified)

Rejects due to damage (about 10% of total) they accept and do nothing to reduce this number.

The price that collectors pay depends on the daily market price. Information on price is provided by collectors and whole sellers in Hanoi or from commune market, and the demand-supply relation on markets.

Collectors offer prices based on the actual situations of flowers, for flowers of higher quality, they would offer higher price and vice versa. When the prices are low, roses are stored in the cold storage room to wait for better prices. Storage is done for a maximum of 2 weeks.

The collected flowers are sold:

- Directly to street vendors in Quang An night market in Hanoi
- 70% go to flower shops for higher price,
- To collectors from other provinces (Hai Phong, Quang Ninh, Nam Dinh) that buy directly from Me Linh collectors instead of on the night market

Red rose is still the most popular flower among consumers, but in recent years, there has been an increasing demand for roses of other colors such as white, yellow, and pink roses. Besides roses, customers are more and more interested in expensive, luxurious flowers like lily and orchids. Me Linh flowers are usually consumed by the people with lower incomes. A flower shop owner in Hanoi mentioned she would never buy Me Linh roses, due to their low quality and short vase life.

The group of flower collectors interviewed disagrees on the changes in rose quality during the last five years. Some believe that the quality is higher and more varieties are available compared to the last 5 years, while others consider that the quality has decreased due to falling prices which do not encourage the growers to take care of the plants. According to this last group, growers now use cheap, low-quality or illegal pesticides and fertilizers to cut costs. According to them this leads consequently to a poorer quality of roses and higher environmental damage.

7.3 Flower selling at Quang An night market in Hanoi

Daily street market in Hanoi is from 2 to 5 in the morning. There are a few delimited (iron roofed tables illuminated with light bulbs) selling points, specially built for the Da Lat Growers, and also a few imported (from China and Thailand) flowers, next to some complements for flower arrangements are being sold. The rest of the selling points are not visibly delimited, not illuminated, but they are obviously not free for anyone, since a fight was witnessed between one arriving vendor and the vendor that was (illegally?) selling on that particular spot, ending finally in the departure of the seller that was there first. Vendors must pay a fee, which is collected twice a month.

Growers and collectors (we met one of the Me Linh collectors) bring their flowers on the back of the motorbike (dry, unpacked, sometimes partially wrapped in cloth or paper). Sometimes the flowers are partially unloaded and placed on the floor in front of the motorbike; other times the motorbike is both transport system and selling table.

Besides an enormous amount of roses of many different qualities, the researchers were amazed by the huge variety in flower types (see pictures 7.4.1); among others, the vendors sold the following:

- Many rose colors (sweethearts, intermediates and T-hybrids)
- Chrysanthemum and spray-chrysanthemum
- Alstroemeria
- Bouvardia
- Limonium, both sinuatum (statice) and latifolium
- Lilium, both longiflorum and Asiatic Hybrids
- Liatris
- Gerbera
- Gladiolus
- Tuberose (Polyanthus tuberose)
- Strelitzia (Bird of paradise)
- Musa (banana flowers)
- Lotus flowers and lotus fruits
- Carnations
- Orchids (Cymbidium, Paphilopedilum, Dendrobium and other)
- Gypsophila
- Solidago
- Aster
- Cut greens (asparagus, datiles, furns, elephant grass)

It was observed that there are two types of buyers: the ones buying big quantities and transporting them on the motorbike, and retailers, the so called street hawkers, buying small amounts that they transport on baskets in the back of the bicycle. Buyers inspect the product with a flash-light. Asked about their buying criteria, they all mention the bud size, length of the stem and the ‘freshness’/ greenness’ of the leaves. Neither sellers nor buyers seem to be concerned about the pesticide residue on the leaves, they believe after 3 days it has ‘dissolved’ and it is no longer harmful. Most of the roses still have the protecting paper

around the bud. The sellers wetted the flowers frequently. Is it to make them to look fresh, or also to cover the white color of pesticides residue?

Portrait:

One of the female flower collector from Me Linh is everyday from 1 till 6 am at the flower market already since 10 years. She drives her motorbike several times from and towards home in order to bring the contents of her cold store, which she built 5 year ago. This allows her to save flowers longer till selling them at a more attractive moment. This practice, although very detrimental from a (European) quality and vase life point of view, has allowed her to increase her turnover.

7.4 Market access constraints

7.4.1 Me Linh

Currently, Me Linh commune has two rose markets, being Ha Loi market and Hoi Market. Ha Loi market is the market were the majority of roses are sold annually. Hoi market was established in 2003 and is often held in the afternoon. Roses are mainly collected here before being transferred to Ha Noi. The most important market destination of Me Linh roses is the Quang Ba Whole sale market in Hanoi. However, during the last 6 years, the growers observe more competition of roses from other areas such as Sapa, and the introduction of other flowers. All interviewed growers and other local representatives from Me Linh Commune indicated that the most prosperous period for them of roses had been between 1998 and 2001. After 2001 the sales price of the roses has decreased continuously. This decrease is due the continuous growth of rose production area in and outside the

region, the introduction of higher quality roses from other regions such as Sapa, the introduction of other flowers, both from the region but also from foreign countries. This trend has caused pressure on the applied cultivation practices, since some farmers are trying to cut production costs, by reducing the application of fertilizers and pesticides, others have changed the pesticides used to lower quality ones, sometimes illegally imported from neighboring countries.

In order to improve the competitive position of their roses in the market, some growers have invested in cool storages. In these storages they do not only store their own flowers but also the ones of other growers. The advantages of this storage, is that flowers can be stored here for a maximum of 14 days. This allows the growers to anticipate in a more effective way on market price changes because the visual quality (the aspect of the flowers) is preserved.

However, from the internal flower quality point of view, flower storage during several days is very detrimental. During cold storage the metabolic rate of the flowers is slowed down, but there is still activity. Especially during dry storage, because flowers use water for their respiration and loose it through transpiration, and there is no water available to absorb through the stem, the flowers can loose a lot of water. Dry storage in a wet environment as seen in Me Linh area, reduces the water loss considerably, but increases the risk of infection with fungi like Botrytis. After prolonged dry storage, flowers often lose the capacity to re-hydrate once they are placed into water at the consumer level, and this is an important cause of vase life termination.

Longer storage times in order to obtain higher prices is a short-term policy: as the prices go up, consumers usually expect a longer vase life; disappointed consumers might give up buying flowers when they are expensive, because they know that these flowers will give even a lower satisfaction than average. Real freshness of the product and vase life guarantee are more and more parameters for quality evaluation in world flower chains, and a label with the harvest date on a bunch of roses at a British supermarket is no longer an exception.

Also, some growers have started to create direct sales relations with retailers, or with flower markets in the surroundings of Hanoi. The direct sales to these segments, offers an extra service to the buyer whom does not have to travel to the whole sale market in Hanoi.

7.4.2 Sapa

In the past, roses cultivated in Sapa used to meet the demand of people within the Lao Cai province. In 2004, the rose sector expanded its sales to other provinces/ cities such as Ha Noi and Ho Chi Minh. From these markets, roses were transferred to other provinces throughout the country, especially the Northern provinces, including Quang Ninh, Hai Phong and Thai Nguyen. Sapa has a favourable geographical position regarding the export of roses to China. However, the district has not yet developed a strategy for entering the export market, and also a huge flower growing area is developing in China, and Chinese flowers are penetrating the Vietnamese market, see also 7.4).

This might change in the near future, since ATI Sapa Rose Valley Resort has made the first steps to export. In 2006 they sent samples to flower buyers in Singapore and the Czech Republic. Interesting remark, is that one important observation made by these

buyers was the short period used between the last application of pesticides and harvest. It was indicated to ATI that this practice was not market conform and should be adjusted.

The Head of the Economic Department of the people commune committee Mr. Duong Duc Huy informed on the plans to create a growers association for the different crops in the region, including flowers. One of the objectives of this association is to strengthen the production and sales capacity of the local growers. As a first initiative to stimulate the horizontal integration of farmers, the Economic department has stimulated and supported the establishment of small cooperatives or producer associations. These associations consist of 3 to 7 growers. Based on our interviews with representatives of these associations, it was understood that the integrants are mostly neighbouring growers. They indicated as advantages for association, the increased efficiency in buying inputs (materials, pesticides, and fertilizers), reduced costs of transport per unit, and the improved negotiation power towards the buyer.

Around eighty percent of the Sapa roses is transferred to Ha Noi. Roses sold in the Sapa market are low quality roses (type 2-3). High quality roses (type 1) are sold in other markets. Due to the long distance to the main market, growers are used to agree with wholesalers by phone on the sales conditions. Based on the order, the roses are harvested and carried to a central collection point in the region. Here roses are sorted by quality. From there, roses are transferred to Hanoi by truck. Pesticides use or residues are not considered to be important as a sales requirement. However, one of the leaders of a association informed that he does not apply pesticides shorter than 10 days before the harvest, to reduce a possible bad smell during the transport and the storage in cool houses in Me Linh.

There is no cold store room available in the region. This limits the possibility of the growers to anticipate on the periodic fluctuations of the market price.

8. Research objective 2: Information, knowledge, and learning on sustainable rose cultivation

8.1 Access and availability of information on pesticide use and environmental friendly cultivation

8.1.1 Relevant actors

Me Linh Commune

In Me Linh Commune growers, local district officials and a representative of the district plant protection department were invited to indicate the relevant actors that provide information to rose farmers on production practices. Due to time limitation only the relation between sector supporting actors and flower growers were discussed. The existence of possible other relations between the supporting actors were not specified nor discussed. Figure 8.1 presents the actors indicated by two representatives from the People Commune Committee and 1 representative from the Extension Office. Figure 8.2 presents the actors indicated by 6 rose growers from Me Linh Commune. Figure 8.3 presents the actors indicated by the director of the plant protection department at district level.

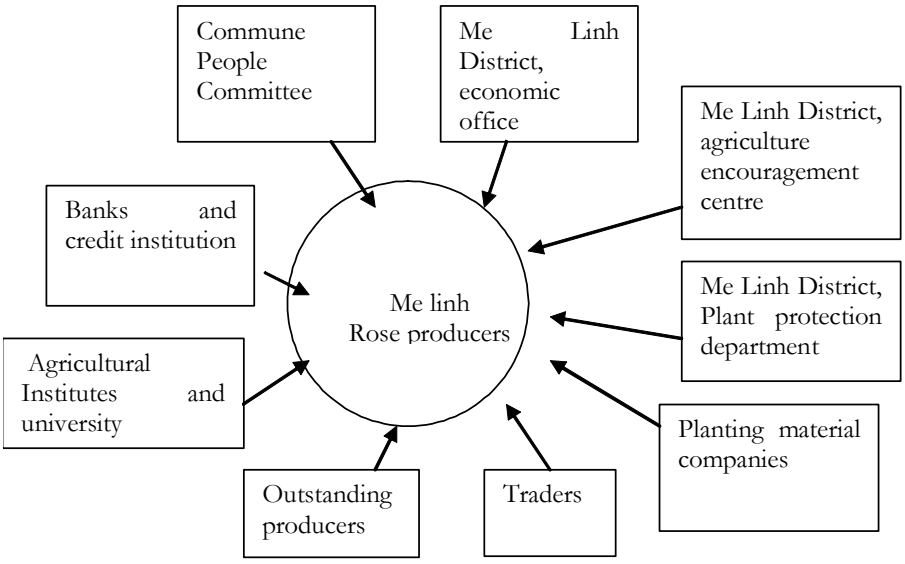


Figure 8.1 Description of Me Linh commune officials on the actors involved in informing and supporting rose farmers

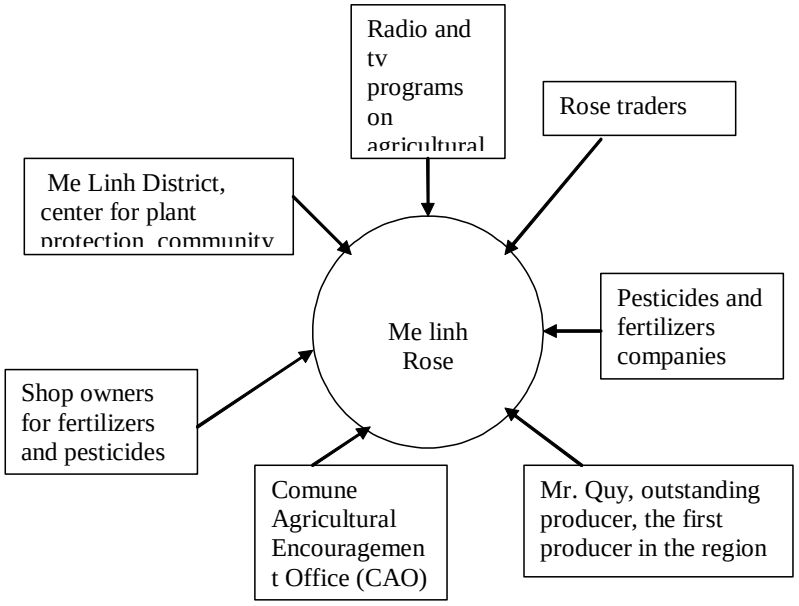


Figure 8.2 Description of rose growers on actors providing information and support towards the sector

Based on interviews with the different stakeholders, it can be observed that rose growers rely most and use most frequently the information provided by other growers regarding floriculture practices and pest control methods. Besides that, also rose traders are considered to be important informants, but than especially regarding information on market demand and market trends. Regarding the institutional support structure, the role of the Plant Protection Department (PPD) is most recognized by farmers and local authorities. However, information provided by them is mostly focused on the development of pests and diseases and pesticide use. The PPD at department level organizes meetings on pesticide use and other related topics. Part of these meetings is managed by their own professionals. But also some meetings are organized by the PPD for representatives of pesticide producing companies. In these meetings new pesticides are introduced to the growers. PPD also has a small influence on the introduction and use of legally approved pesticides (see also chapter 6.1). At field level they issue certificates to the pesticide shop owners, and control regularly their performance by surprise inspections.

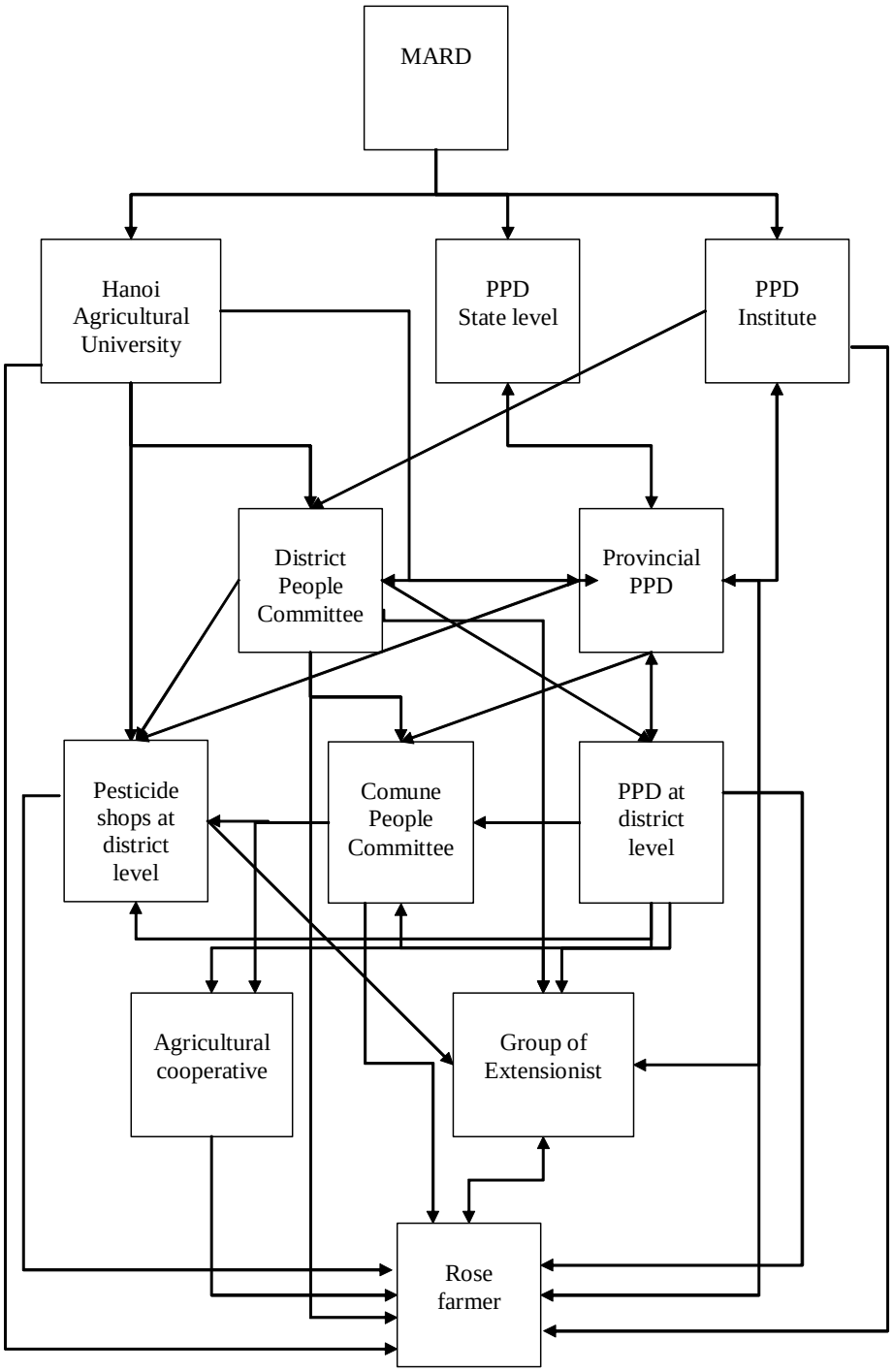


Figure 8.3 Indication of PPD district official on actors providing information to rose farmers in Me Linh commune

Sapa

In the case of Sapa, figure 8.2. and figure 8.3. were presented both to the local authorities, to the vice president of one of the cooperatives and to the supervisor of the ATI company.

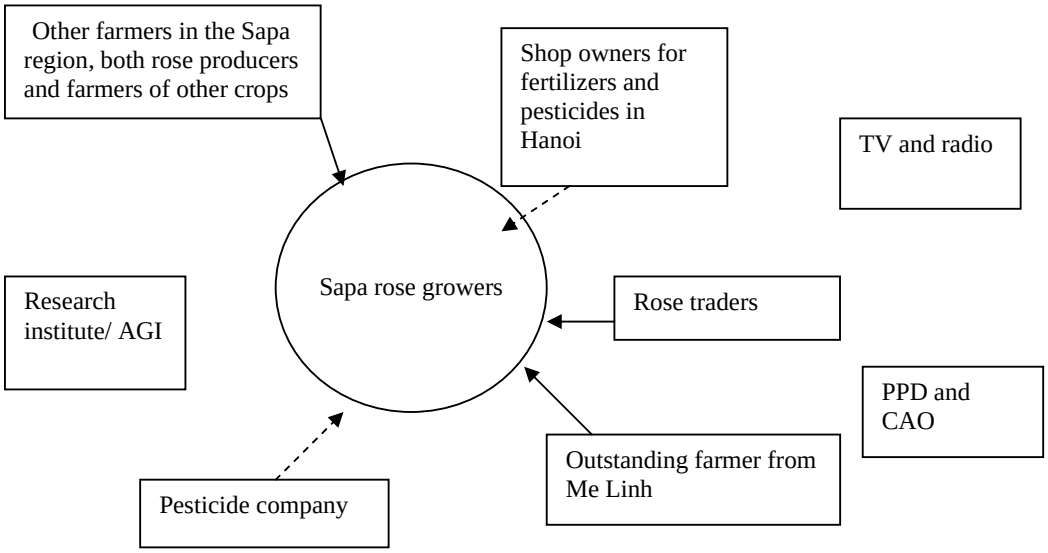


Figure 8.4 Indication of most important informants for cooperative and private company in Sapa

Figure 8.4 shows some actors being connected with interrupted arrow lines, and some actors without any connection to the farmer. The actors not being connected at all, are actors being present in the region, but they are not considered to have any significance for the rose growers. The actors connected with interrupted lines, are actors recognized being present in the region, but the rose growers consider them having a very limited significance regarding informing the Sapa rose growers. In the case of PPD and CAO, because of their limited practical knowledge on rose production. In the case of the pesticide company, because they visit the region very rarely and provide complicated information and limited samples of a new product, for which it is difficult to try the effectiveness of a new product.

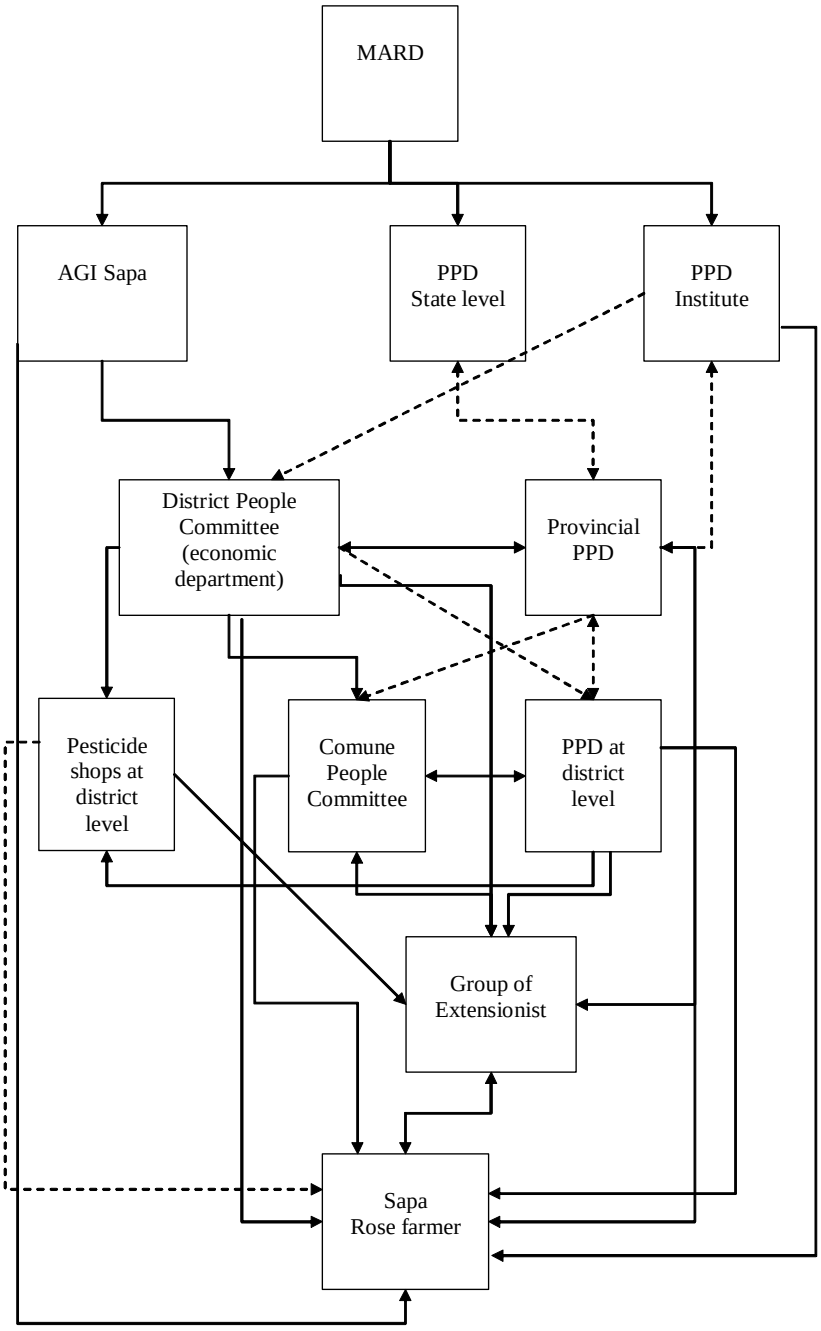


Figure 8.5 Description of institutional structure supporting the Sapa rose growers

In figure 8.5 the effect of the distance between Sapa and some more centralized organized institutes can be observed. These institutes, such as universities and the plant protection research institute have their main offices located in Hanoi and for this lack to provide effective support on informing and supporting the rose sector in Sapa. The

interrupted lines indicate the weak linkages between these bigger institutions and the Sapa rose sector. Also, the role of local pesticides shops is less recognized than in Me Linh, since these shops are relatively new in the region, and provide a limited number of products. For this reason, rose growers buy their products directly in Me Linh or Hanoi, throughout the support of the rose transporter, whom delivers the roses and collects the pesticides ordered by the farmer. This practice limits the opportunity for Sapa rose farmers to be in direct contact with pesticide providers and learn about new products.

Finally, a difference between Sapa and Me Linh exists related to the level of organization of the Sapa farmers. In Me Linh exists an agricultural cooperative. Based on the information collected in the interviews it has not become clear which exact support is provided by this cooperative. However, it became clear that their support regarding the introduction of new practices in the rose sector is limited and that the growers in this region organize their production and sales mostly at an individual level. In the case of Sapa horizontal integration as a chain development strategy has been applied more. This can be explained by their more inconvenient position towards the markets, for which their need is bigger to increase the production scale in order to reduce transportation costs per farm, but also to improve the negotiation power towards the market.

Table 8.1 Description of the roles of the most relevant actors regarding rose production in Me Linh and Sapa

Actor	*Roles*	*Remarks*
Ministry of Agriculture and Development	Define laws and regulation. Define short, mid term and long term policy plans regarding the development of the sector.	For the period 2005-2008, the ministry has defined a policy plan on the sustainable development of the agricultural sector.
District agricultural encouragement center: Post Harvesting Technological Institute (VIEAP), Institute for Genetics and Biodiversity (AGI), Agricultural University (HAU)	Instructing the transfer of agricultural materials and application of new technology; giving technical training courses; informing farmers the latest development on flower planting; organizing meetings and conferences on flower planting techniques; building performance models Evaluating and detecting the present practice of flower planting in the area	1. All the activities are still in evaluation phases. There are no flower market investigation 2. In the case of Sapa, the local actors do not indicate clearly receiving any direct support from HAU, but mention more often the support of AGI, throughout their local office in Sapa.
National Institute of Plant Protection (NIPP)	Applied research on crop, pesticide use, diseases, integrated pest management	Not yet research programs on flower cultivation.
State Plant Protection Department (SPPD)	Forecasts on pest and diseases, information on pesticide use, new products experiments, legal control on pesticides use.	
Provincial Plant Protection department (PPPD)	Issue the permit to pesticide traders, in situ inspection of pest and diseases, report on pest and diseases forecast, organize the pesticide shop inspections, inform on pest and diseases emergencies, inform on legal restrictions of pesticides sales.	

Actor	*Roles*	*Remarks*
Commune People's committee	- Drafting direction and regulations for developing roses, including the areas, yield, varieties, quality; creating favorable market conditions; organizing technical training course on fertilizer, pesticides used.	Wholesale market building, creating favorable conditions for flower trading with Chinese partner.
District economic department	Giving direction on economic related activities; advising district people's committee on encouraging farmers to remain and develop areas for flower planting. Coordinating with communes people's committee on market expansion	In the case of Sapa this department plays also an important role regarding the stimulation of horizontal integration between farmers (small cooperatives), the establishment of local pesticide shops, and the future establishment of a regional farmer association.
District PPD center	Local support on data collection and reporting regarding pest and disease forecast, Organizing training courses on fertilizers and the use of pesticides; examining and supervising pesticides shops	Examining the shops two times per year or randomly
Planting materials and pesticides companies	Organizing training courses; introducing new pesticides, fertilizer and effective, safe use of pesticides	Introduction activities are held once or twice a year by pesticides companies such as Syngenta, PPD I, Hoa Binh, Sai gon. Fertilizer companies such as Binh Dien, Viet My ADC, Con Co.
Traders	Buying and stimulating the development of the rose market. Supplying production materials such as pesticides pumping machine, flower trimming tools. Plastic paper and paper for covering bulbs	Traders often want to reduce buying price. However farmers also know very well the daily market price in the case of Me LInh. In the case of Sapa, the long distance between the production area and the final market destination and the absence of post harvest services, limits the negotiation power of the farmers.
Outstanding farmers	Creating markets for trading seedlings, supply new varieties. Exchanging planting techniques and secrets to increase the flower yield; participating in flower consumption, market expansion and customers preferences.	Producing flower in other regions such as Sapa, Moc Chau, Ha Giang
Banks and credit institution	Offering loans with different interest rates	Vietnam bank for social policies, Agri-bank. The Commune People's Committee has no effective influence on loans. Banks have no detailed technical support to farmers. The People's credit funds give

Actor	*Roles*	*Remarks*
		easy loans but with high interest rate
Agricultural Cooperative	Collect and share information on pest and diseases, pesticides use and legal information for the rose sector in Me Linh, organize field trips and meeting	Does not have a very active role in the district. Growers tend to work at a very individual level.
Group of extension officers	Observations directly in the field on pest and diseases, advice farmers in the field	From the interviews the impression exists, that the advise is mostly focused on pest and disease control.

8.1.2 Information flows and sources

Based on the interviews with representatives of the local authorities in Me Linh and Sapa, figure 8.6 was drawn. This figure reflects the existing institutional structure created to support rose growers, and the linkages between the different actors indicated.

The numbers presented in figure 8.6 refer to the information flow between the actors mentioned in the structure. Also, information was collected on the communication mean that is used by these actors to exchange information among each other. This information is presented in table 8.2.

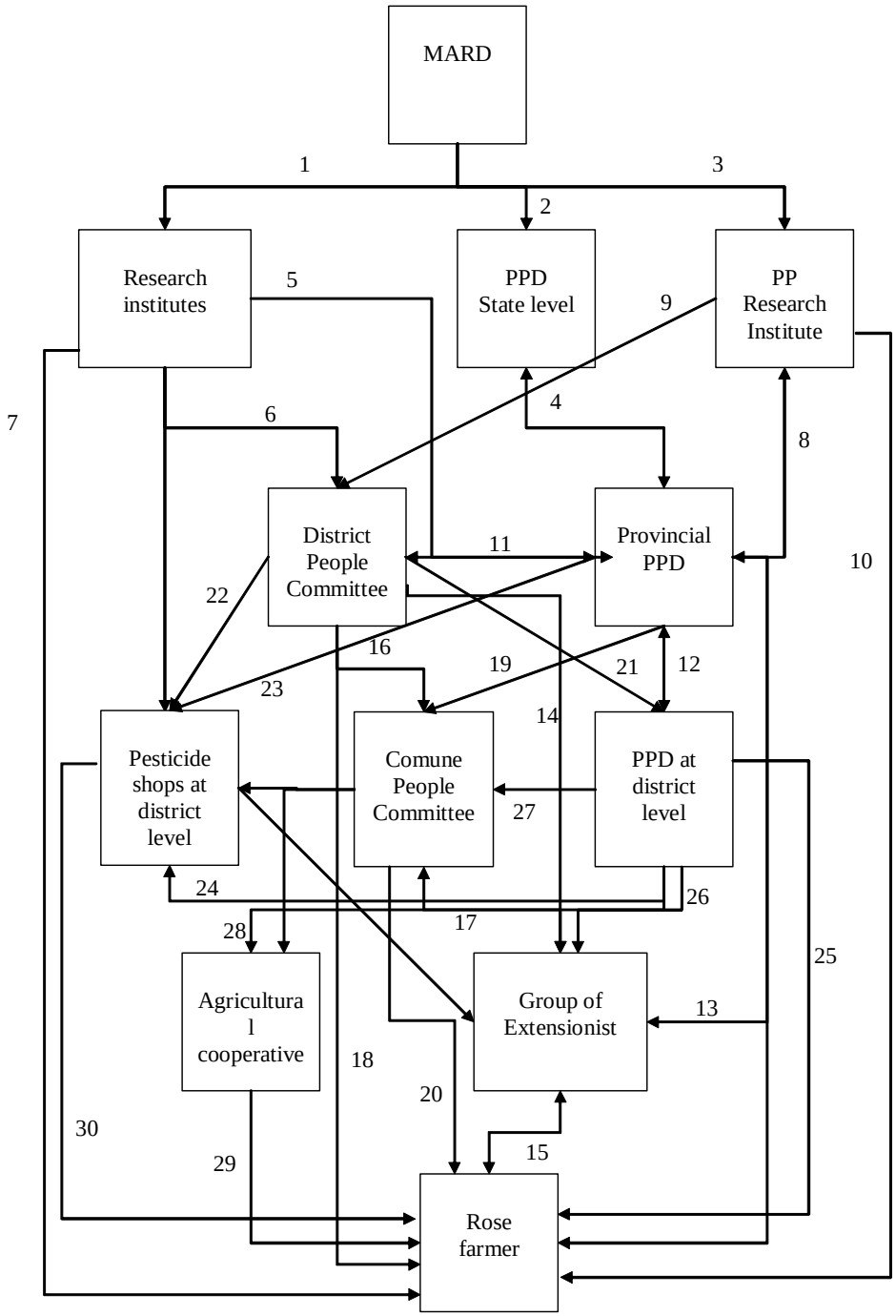


Figure 8.6 Institutional linkages on rose producer support regarding production practices

Table 8.2 Specification of the institutional linkages and most common used communication mean

Number of connection	*Institutional relation*	*Communication mean*
1.	MARD to Hanoi Agricultural University (HAU)	Report on research findings, assignment budget
2.	MARD to SPPD	Report on research findings, assignment budget
3	MARD to IPPD	Report on research findings, assignment budget
4.	Between SPPD and PPPD	Leaflets, publications, mass media, conferences at provincial level
5.	HAU to PPPD	Research publications, student internship report, conference
6.	HAU to district people committee	Reports on research projects, student internship reports
7.	HAU to farmer	Field trip, experiments
8.	IPPD to PPPD	Report on research experiments, model showing, conferences.
9.	IPPD to District people committee	Report on research experiments, model showing, conferences.
10.	IPPD to farmer	Show the results of the experiment, field trip, experiment together on pesticide use.
11.	PPPD to District people committee	Report on pest and disease forecast, inform verbally on inspector visit.
12.	PPPD to DPPD	Report on field inspection and pest and diseases forecast, mass media (every week), training
13.	PPPD to farmer	Mass media and TV information on pest and diseases, organize and inform on informative meeting on pesticide use.
14.	District people committee to Group of Extensionist	Report on pest and diseases, and telephone meeting in case of emergency.
15.	Group of Extensionists to farmer	Meeting, field visit and radio communication on pest and diseases.
16.	District people committee to commune people committee	Report and meeting pest and disease forecast and planning of other meetings in the area.
17.	Commune People Committee to Group of Extensionists	Report and meeting on pest and diseases. Telephone in case of pest and diseases emergency.
18.	District People Committee (district economic office) to farmer	Inform through common meetings with farmers on specific activities and projects in the region.
19.	PPPD to Commune People Committee	Inform in meeting on pest and diseases forecast, direct communication between officials in case of emergency situation.
20.	Commune People Committee to farmer	Daily commune radio communication on issues regarding agricultural activities, amongst others pest and diseases.
21.	District Commune People to DPPD	Document for specific projects, telephone communication for planning.
22.	District people committee (through economic office) to pesticide shop owner	Telephone communication and reports on trials and experiments, get new pesticides from pesticide producer give these to shop owners for them to give them to the farmers.
23.	PPPD to pesticide shop owner	Document and meeting to share information on new legal restrictions on product use. Certification issuing.
24.	DPPD to pesticide shop owner	Document and meeting to share information on new legal restrictions on product use.

Number of connection	*Institutional relation*	*Communication mean*
25.	DPPD to farmer	Radio broadcast on pest and diseases forecast, legal information and other information.
26.	DPPD to Group of Extensionists	Report on field work, telephone communication to organize meetings
27.	DPPD to Commune People Committee	Report on pest and disease forecast, pesticides, periodical meetings.
28.	DPPD to agricultural cooperative	Report on pest and diseases, pesticide use, legal information for rose growers, meetings.
29.	Agricultural cooperative to farmer	Meeting in the field and field trip
30.	Pesticide shops to farmer	Provide information on product use and new products.

Analyzing the structure presented, one can identify different levels of linkages and flows of information. These differences are related to the different roles the actors play within the supportive structure towards the rose sector. Depending on these levels, also the type of information exchanged is distinctive. In order to obtain a more clear idea on these different levels, the next paragraphs present the linkages and information exchange at three levels; planning, research and development, identification and control of pests and diseases, and the control of pesticides use and new pesticide product introduction.

8.1.2.1 Planning, research and development for the agricultural sector.

The highest, most scientific and political level, consist of the exchange of information between the Ministry of Agriculture and Development, Research Institutes, the Plant Protection Department at state and provincial level, the Plant Protection Research Institute and the District People Committee (see figure 8.6).

The Ministry of Agriculture and Development (MARD) is responsible for the design and budgeting of annual policy plans regarding activities to be developed for the agricultural sector. The different supportive institutes such as research institutes and PPD present annually their project proposals. Based on these proposals, MARD decides which projects will receive funding. In 2005 MARD has defined a 5 year policy plan, which is focused on the sustainable development of the agricultural sector. As part of the program it stimulates the development of new initiatives, provides financial support for the development of new knowledge and technology and searches for new partnerships.

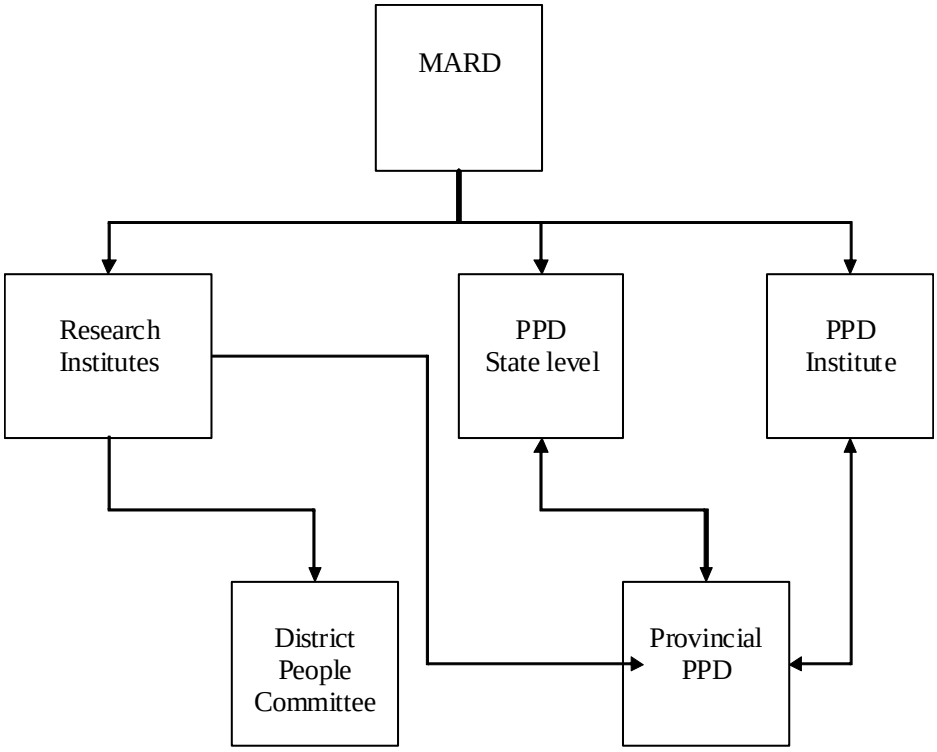


Figure 8.6 Information flows between state, provincial and district level

PPD at state and province level receives from MARD support for their annual activities. Regarding pesticides control, MARD publishes every March the list of state approved products. This list also indicates the crop or cultivar the product should be used for. In September an additional list is published with products that have been added to the list since the beginning of the year.

The Plant protection Research Institute works on research projects throughout the whole country. The research focus is on improving production methods. Most of the research has been done on important food safety crops such as rice, vegetables, fruit and industrial crops such as soy bean, coffee, tea, pepper and sugar cane. Flower is a relatively new cultivar in the region and for this still very limited considered in the research programmes.

Regarding the relation between pesticides use and agricultural activities, one could say that the mandate of the PPRI is to find solutions for problems caused by pests and diseases. For this reason also research is done on integrated pest management. The knowledge collected is especially shared with MARD. Besides that, the PPRI has also made protocols and developed training programs to guide extension officers and farmers on the proper use of pesticides. The role of the Plant Protection Department on the other hand is more focused on the management and control of activities related to the presence of pest and diseases.

Regarding research institutes and their relation with the rose sector, the Agricultural University of Hanoi was mentioned by several interviewees. Their support is related to

doing applied research, sometimes also through student internship projects. Their formal institutional relation is with the Ministry of Science and Technology. However, the development and outcomes of research programs with agricultural objectives are of importance for MARD. The results of these research programs are sometimes published. Also reports with research results are presented to the District People Committee and the Provincial PPD. Sometimes also farmers are involved in learning about field research through small field visits.

In the case of Sapa, the presence of AGI was mentioned more than HAU. This is explained by the presence of a local research station near Sapa. AGI is identified by the interviewees as a provider of information throughout organizing little seminars. Also, they do applied research and share their results especially with MARD.

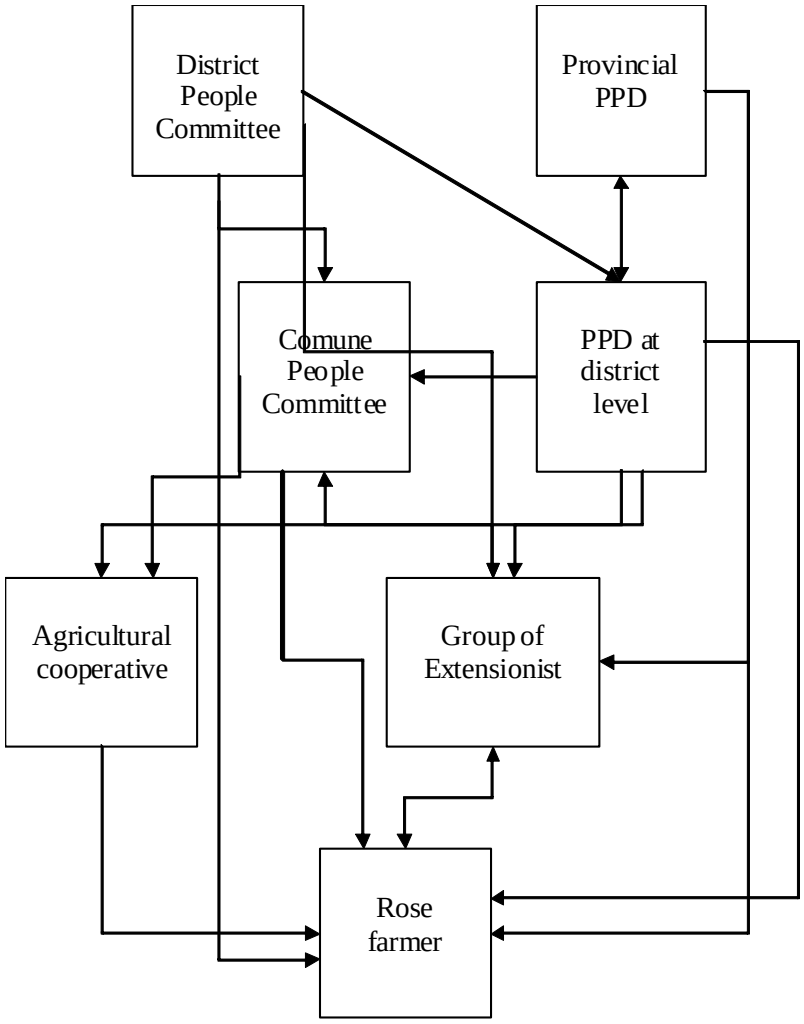


Figure 8.7 Information flows between local authorities and rose growers

8.1.2.2 Identification and communication on pest and disease and pesticides application

Graph 8.7 shows the information flows and sources between the local authorities and the rose growers. The information flows between these actors are especially related to the identification of pest and diseases in the field and the recommended pest control. This identification is done by the Extension Officer. He reports back to the Commune People Committee. This is a written report. The CPC reports again to the PPD at district level and together they inform once a week through provincial television and radio the appearance of pest and diseases and the recommended pesticides use. In case of a pest and disease emergency situation, the communication is more direct. Officials of the CPC and the Extension Officials then visit the farmers directly and inform them on the advised actions to be taken.

8.1.2.3 Information flows on the use of legally approved pesticides and new product introduction

Graph 8.8 shows the institutional linkages and information flows related to the legal control on pesticides use and the introduction of new pesticides in rose production areas. In this case, PPD at state level together with MARD defines annually the list of approved pesticides (see for further details on the approval process chapter 6). This information is accessible for all relevant stakeholders, including the local pesticide shops. Also, the owners of the local pesticide shops might expect one or two times a year a surprise visit by PPD officials from district level. They will check the legal status of the products sold. The visit is made possible with the support of the District and Commune People committee. Besides that PPD at district level organizes periodically training activities for the shop owners. Based on the results of the shop inspection and their satisfactory participation in the training, the pesticides shops receive their certificate to operate. PPD at provincial level issues the certification for a period of three years. The shop owners have to participate every year in a refreshment course. Based on their participation they will be able to renew their certificate every three years.

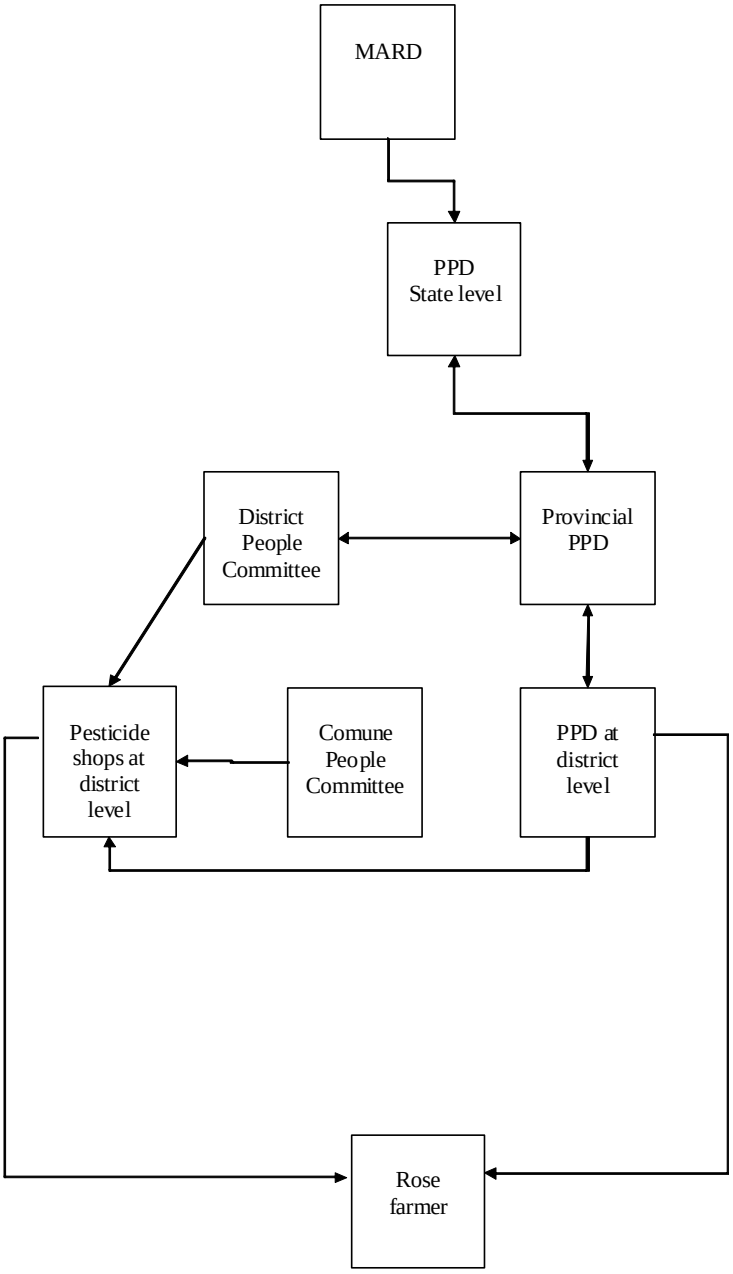


Figure 8.8 Institutional linkages pesticides control and the introduction of new products

Regarding the introduction of new pesticides, the PPD at district level together with more locally oriented authorities help representatives of pesticides producing companies to organize meetings for growers. These meetings take place in the production region. During the meeting the representative explains the characteristics of the new product, the application method and the instructions for safe use. After this, in Me Linh sometimes the

area is visited where the new product has been applied. In Sapa this is not the case, because the experiments are mostly done near to Hanoi. At the end of the meeting the growers receive a sample of the new product and a leaflet with information.

Additionally to these meetings, the PPD sometimes organizes meetings themselves to inform farmers on some agricultural practices, such as the safe use of pesticides. However, from the conversations with the Me Linh growers, the interviewees created the impression that these meetings do not contribute growers with useful new knowledge on new production practices. In the case of Sapa, the growers interviewed expressed clearly that the meetings where not useful, since they considered that the local PPD representatives have a lack of knowledge and experience in the rose sector.

8.1.3 Information availability and accessibility

Based on the interviews with the farmers in Me Linh and the representatives of the cooperatives in Sapa, it is understood that the most important source of information farmers use to learn about cultivation practices is information obtained from other farmers in the region. In the case of Sapa, also the opinion and information of Me Linh farmers is very important. Farmers from Me Linh provide for instance information on pest control methods, pesticides use and cutting and pruning methods. All this information is made available throughout direct contact and farm visits.

Besides the information obtained from other farmers, the information of rose traders is considered the second most important source of information. In the case of Me Linh, the farmers have easily direct contact with rose traders. Part of the whole sellers buy their flowers directly in Me Linh commune whom sell the roses afterwards at the Ha Noi night market, or to rose shops and to street hawkers. Some farmers store their roses in cool houses and transport the flowers themselves in a favorable moment to the market. These farmers sell directly at the Hanoi night market, to flower shops and to street hawkers. The information they receive from the different types of sellers, is related to the quality of the flower. This information is provided in a verbal way. The characteristics used for selection are; the size of the bud, the length of the stem, the straightness of the stem, the fresh green color of the leave and the diversity of colors. In various occasions sellers and buyers were asked if pesticides use and residue were considered to be a criterion for selection. This was not considered to be important by buyers at the night market, flower shops and street hawkers. One of the leaders of the cooperatives in Sapa indicated the importance of not applying pesticides too short before the harvest, to increase the lifetime of the flower after harvest, and prevent bad smell of the roses during the transport. But the source of information that created this awareness was not identified. Most probably, it was based on the feed back received from transporters or intermediaries in Me Linh.

Regarding information on production methods, also small meetings are organized by the Plant Protection Department. Five of the six farmers interviewed indicated to attend these meetings. These meetings are for free and organized near the production areas. The information is provided in a verbal way. Also sometimes visits to the field are organized. The growers interviewed in Me Linh indicated that no official training on production practices is offered to them. In Sapa some representatives of the cooperatives indicates to

have participated in formal courses organized by AGI on production methods and floriculture.

In the case of the PPD meetings organized for representatives from the pesticide producing company, the information provided in the meeting with the growers is verbal. At the end of the meeting the growers receive a sample of the new product and a leaflet with information on the product characteristics. All growers interviewed in Me Linh indicated to attend these meetings. The meetings are for free. The representative of one of the cooperatives in Sapa indicated that the information provided in these meetings was too difficult to understand. This could be also the case for the other farmers, but was not discussed in detail during the meeting in Me Linh.

Some growers and authorities in Me Linh indicated the existence of research activities by the Agricultural University of Hanoi. However, the farmers interviewed indicated that the results of these researches are not really shared with them. The officials of the extension office and the representative of the PPD office indicated that reports are made of these studies, but it did not become clear if these reports are presented to these officials. There were no indications found of the existence of an active role by researchers to share the results of their research and possible suggestions for improvements directly with the growers. It could be that these results are shared at a higher institutional level, and that the suggestions for changes drip down to the growers in a more practical way when the extension officials visit the field. All five growers interviewed indicated the frequent contact with the extension officer. However, the information shared with the producer is mostly related to the identification or forecast of pest and diseases and the required use of pesticides. This information is broadcasted on a weekly base through the provincial radio.

8.1.4 Existing initiatives on adjustments of production methods

In the Me Linh Commune rose growers were asked to indicate the most important adjustments that the rose production and trade had experienced in the last 5 years. Table 8.3 presents the information collected. After drawing these adjustments and their relation to the rose producer, we asked the growers on their perception of the cause of these changes, and the actor whom influenced them to make these changes. This information is also presented in the table.

Table 8.3 Inventory by rose growers of most important adjustments made to flower production and post harvest activities in Me Linh in the period 2001-2006

Adjustment made by farmers	*Reasons for changes*	*Who informed/taught them*
Some farmers increased their production area	Flower production is more profitable than rice. More human resource available. More land rented from other communes. More profit. Market demand.	Farmers themselves
Introduction of more varieties, more colors of roses.	Market demand. More profit.	Flower Traders and collectors. Customers.
More use of pesticides and fertilizers	Soil degraded after years of cultivation. More pests appeared. Pests became familiar with pesticides. Improves quality of the flowers. More money available to invest due to the increase of income	Farmers' own observation. Flower traders and customers.
Better planting, trimming, harvesting techniques	Fewer workforces required. More profit. Improves quality flowers.	Farmers' own observation. Learned from techniques applied by farmers producing other crops or outstanding farmers producing roses. Market demand.
Combination of wholesale and direct selling	Change in workforce (more people involved) Higher income through direct sales Improved infrastructure and transport	Farmers' own awareness.
Production of varieties.	Higher profit. Increased areas. Better skills and techniques. More workforces. Accessibility.	Higher family income. Demands from rose growers and farmers.
More machines, tools and materials used.	Work completed faster and easier and more effectively. Better cultivating facilities and infrastructure provided. Families have more income to invest.	The commune authority. Farmers informed each others.
Less workforce directly involved in farming work.	More modern techniques and machines used.	Farmers' awareness and calculation.
More use of cold storage for flowers.	Better profit for sales are made on special occasion. Some wholesale traders and farmers keep for selling in bulk. For better quality flowers (color).	Farmers' experience and traders' advice.
Soil preparation (simpler and quicker).	Better knowledge and experience on production of rose. More machines involved. Less direct workforce.	Farmers' own experience and observation.

One can observe from the list of changes indicated, that the production chain has experienced some changes towards functional specialization. New actors got involved, providing business development services, which helps the rose growers to improve their negotiation position in the market. Also, adjustments have been made to the production methods, partially to improve the quality of the flower and to comply better to market requirements. But also adjustments have been made, to reduce costs for the growers to be better able to cope with a continuous decrease of sales prices and increase of competition.

The information of table 8.3. was also presented to a number of small scale rose growers in Sapa. The most important differences in adjustments they observe in their region in comparison to Me Linh, are:

1. No introduction yet of cold storage.
2. Horizontal integration of growers into growers associations
3. Increased use of fertilizers and same use of pesticides
4. Establishment of pesticide shops in the region.
5. No introduction yet of new flower colors.

The difference between adjustments introduced by small scale farmers in Sapa in comparison to Me Linh, can be explained by the fact that rose production in Sapa is comparatively new. For this, the production chain is still in a process of functional specialization and process innovation to be able to comply to market requirements but also to increase the flexibility and negotiation power of the growers within the chain.

Additionally, the information of Me Linh was also presented to the bigger rose producer ATI. Figure 8.9 shows the adjustments they have made during the period 2001-2006. Most important observation of the differences between their adjustments and the small scale growers, is their orientation on the export market and their willingness to invest in improved production techniques to be able to move towards a new market segment.

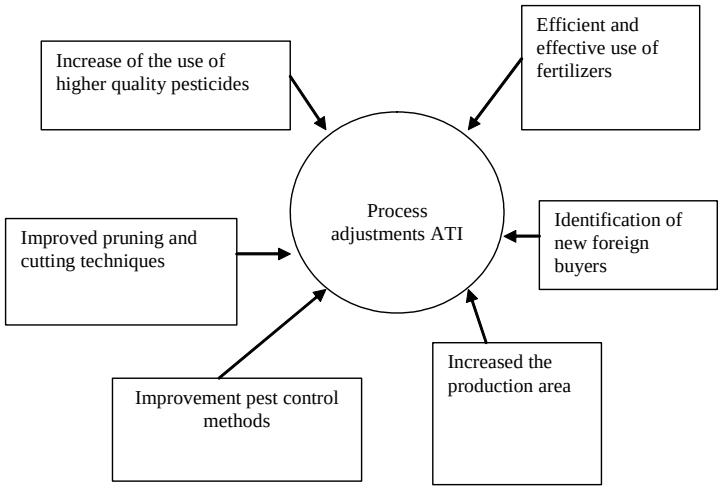


Figure 8.9 Inventory of ATI adjustments made to the rose production and post harvest activities during the period 2001-2006

8.2 Innovation on pesticide use

The representative of the PPD at district level in Me Linh and Sapa informed us on initiatives to stimulate the use of more environmentally friendly pesticides. Instruments the PPD uses to reach this objective, is by taking into account environmental and health characteristics in the registration procedure applied to introduce new products. However, the knowledge and experience of growers on the availability and use of these products is limited, and the decision making within PPD to inform growers on the use of pesticides is most of all fed by the appearance of pests and diseases.

The representative of the pesticide producing company Syngenta informed on the awareness within the company on the relation between the use of their products and their health and environmental impact. For this reason, information on these issues is provided to growers at the moment a new product is introduced. Also a program exist called stewardship which Syngenta uses to coach stakeholders in various countries on the responsible use of their products. However, this program is still poorly developed in Vietnam.

The representatives of the Plant Protection Research Institute informed on research programs focused on the application of integrated pest management approaches. However, these research programs are focused on food crops consumed intensively by the people, such as rice, fruits, vegetables and tea. The importance of the negative relation between pesticides use and flower production on the environment and health was recognized by them as a problem of increasing importance, especially in areas in which food crops and floriculture are produced close near each other. However, integrated pest management has not been developed for the flower sector yet.

9. Observation and recommendations

9.1 Observations on the problem definition

The general problem definition of this field work can be summarized as:

- The abundant and incorrect use of pesticides limits the sustainable development of the rose sector in Me Linh Commune and Sapa.

Based on the interviews with different stakeholders involved in the rose sector, it can be observed that:

- Small scale rose growers in Me Linh and Sapa are not aware of a negative impact of pesticides use on sales opportunities.
- A bigger scale producer in Sapa very recently became confronted with the negative relation between pesticides use and market opportunities based on the feed back received from foreign potential buyers.
- At an institutional level, representatives of the Plant Protection Department observe the need to improve knowledge on the safe use of products to decrease the negative impact of pesticides use on human health. They do not observe a clear relation between pesticides use and market opportunities.
- Representatives of the Plant Protection Research Institute, Syngenta and AGI, observe a negative relation between pesticides use, plant growth and flower quality, and confirm the need to improve the knowledge on integrated pest management methods but also the use of new varieties, better adapted to the local climate and geographic conditions.

For this reason, it can be concluded that a number of stakeholders related to the by small growers dominated Vietnamese rose cultivation sector, reconfirm the importance of doing more research on the relation between pesticides use and market development, and the importance of exchanging information and experiences regarding more sustainable cultivation practices, since this can help the small growers to improve their production, market opportunities, health and environment.

9.2 Observations

Based on the fieldwork, it is possible to derive a number of observations and recommendations regarding the current production methods used, the current practices of pesticides use and the current institutional framework on the exchange of information and knowledge and its possible effect on innovation towards more sustainable production methods.

Since the information was collected based on interviews with a limited number of stakeholders involved, it was decided to limit ourselves to making observations, since final conclusions require a more in depth analysis of the research objectives and an analysis based on a bigger sample of stakeholders. These observations are meant to be an input for further analysis of the topic and a fruitful discussion between the stakeholders involved.

9.2.1 Cultivation practices and its relation with pest and disease incidence

- The current cultivation practices are not very suitable: they have more affinity with extensive crop production (rice, cereals, potato) than with intensive cultivation practices (horticulture, floriculture). There is a lot of opportunities for improvement in irrigation, fertilization and post harvest practices that can directly lead to a reduced use of pesticides, a higher quality flower, and longer vase life.
- In the current cultivation practices, plant health is seen as a synonymous for abundant pesticide use. Too little attention is paid to prevention of diseases by correct fertilization (healthier plants), correct irrigation (less root diseases, and also healthier plants), health of plant material (the seedlings).
- There is a lot of misinformation about the effects of fertilization on flower production and vase life.
- There is a serious lack of hygiene in and around the field and too little awareness on the effect of hygienic measures on the prevention of plant diseases.
- Pests and disease incidence has increased enormously since the starting period of rose cultivation as compared to the time only vegetables and cereals were cultivated.
- Rose growers in Me Linh Commune and Sapa are able to identify a number of pests quite accurately, but in the case of fungal diseases they find it difficult to know which fungus is causing the disease.
- Plant nutrient deficiencies are confused with diseases, which leads to the unnecessary use of pesticides.
- Damage caused by pesticides is not always identified as such, but it is sometimes attributed to fungi, which leads to unnecessary pesticide application.

9.2.2 Commercialization and pesticides use

- The absence of pesticide residue on the leaves is not a quality requirement used by buyers.
- The average vase-life of Me Linh roses is approximately 3 days, however vase life is not a buyer requisite.
- When considering export, pesticides use and residue, as well as presentation and vase life have to be considered as relevant market requirements.

9.2.3 Integrated pest management

- Due to a lack of knowledge on plant health and diseases, Integrated Pest Management is not yet a possibility to combat pests and diseases in the visited areas.

9.2.4 Chemical control

- Chemical control is the only pest and disease control method used by growers in the areas visited.
- Pesticides are alternated without a resistance management plan.
- Growers are not aware of the negative effect of pesticide applications on production, which increases indirectly the costs of every application.
- The purchase of pesticides represents 60% of total production costs in Me Linh area.
- Pesticides are chosen without a proper diagnose and mostly by trial and error.
- The maintenance of the spraying equipment is limited to cleaning the spray tank and parts are replaced only when broken; this can lead to excessive pesticide use.
- The amount of pesticides used in 2005 in Me Linh Commune was two times higher than in 2000. According to the growers, this is due to the rose production. In Sapa the volume of pesticide use is 1.5 to 2 times higher than in 2000.
- All growers interviewed spray the whole field in case of a pest or disease; even if the pest or disease is found in a small area. The impact on the human health and environment increases by doing this. It is also a waste of money and time since more pesticides are used.
- Growers in Me Linh are using 20 to 40 different kinds of pesticides for their rose production. In Sapa the amount of different kind op pesticides used for the rose sector is smaller than in Me Linh Commune. They use 5 kinds of pesticides in most of the cases. Rarely some other pesticides are used as well. The types of pesticides in Sapa are similar with the ones in Me Linh. This can be explained by the fact that the growers from Sapa buy their pesticides mainly in Me Linh Commune. They sell their roses to Me Linh Commune; they get money and pesticides from Me Linh Commune.
- Of the total amount of 28.6 kg active ingredient per hectare, mancozeb accounts for 26.8 kg.
- According to the growers of Sapa the pesticide ‘Tri Tau’ is an illegal pesticide. Growers from both communes are using this illegal product from China; they do not exactly know which pesticides are illegal and which are not.
- In Me Linh Commune 5 different pesticide shop owners were interviewed; in several cases they advice different dosages of the same products for the same pest or disease. They also ask sometimes different prices for the same pesticides.

9.2.5 Estimated environmental and human health impact of rose cultivation

9.2.5.1 Labels

- Growers pay little attention to the labels of pesticide products. Based on the information collected through the interviews the impression exist that the symbols are even not read at all.
- Growers do have concerns about using pesticides but they often do not understand what the real risks are. They care about their health and the environment but increasing the income is the highest priority to the growers.

9.2.5.2 Environment

- Growers of Me Linh Commune do experience environmental problems which they relate to the use of pesticides. Many amphibian animals like frogs and fish, crab and shrimps have greatly reduced in number since 1996. Growers know this because in the past it was very easy to collect food for the meal. Last years it is much more difficult to collect these kinds of animals.
- The growers in Me Linh Commune use groundwater for domestic purposes; Growers in Sapa use mostly water from the mountain. In some cases groundwater is taken from shallow wells. Surface water is hardly used for domestic purposes except for washing clothes. There is a potential health risk caused by pesticides use on the consumption of groundwater.
- According to the rose growers in Sapa, pesticides use do not cause a real problem for the environment.
- In Me Linh Commune and in Sapa a lot of waste like empty packages of pesticides and other agricultural and house hold waste are dumped in the rose fields. The growers do not take care of their environment in this respect. This is not the case for ATI. At ATI the fields are very clean and the waste is collected. This can partially be explained by the fact that the production side is also a ecotourism destination.
- Due to the way of irrigating and spraying by the growers there is a lot of drift to the ditches. All the surrounding water in the communes will be polluted by pesticides. This will cause a potential environmental risk for aquatic organisms, birds and mammals.

9.2.5.3 Human health

- Growers do experience problems with their health which they relate to the use of pesticides. Skin problems (Me Linh commune) and headache happens most frequently. In Me Linh Commune diseases like cancer, skin diseases and infertility have been increased in the last years.
- In Me Linh and Sapa the growers often wear protective clothes while spraying pesticides. In Sapa the temperature is lower than in Me Linh Commune, which might be a reason why growers in this region more often wear their protective clothes. Growers do pay attention to protect themselves but when it is too hot or there is too much work etc. they sometimes do not give priority to this.
- Pesticides are stored at different places like a special room in the house or behind the house; pesticides were also found in a kitchen. Those places are not safe for children and pets. This is not the case for ATI; they have a special place to store pesticides; 6 km away from the farm.

9.2.6 Hazard of pesticide use

9.2.6.1 Assessment of hazards to human health and the environment

- When farmers use formulations with hazardous active ingredients according to the WHO classification it poses a potential risk to their health.

- Risks for human health and environment are estimated by hazard assessment on the basis of farm monitoring and the use of different hazard indicators. Hazard estimations are based on pesticide parameters solely and do not take into account site specific aspects, such as climate, soil type and application practices. Based on the hazard assessment it can be observed that there is a potential health and environmental risk due to the current use of pesticides in the rose production in Me Linh Commune and Sapa.
- Special attention is required for those pesticides which are ranked hazardous according to the WHO classification; very toxic and highly toxic according to aquatic or terrestrial toxicity indicator; high according to the GUS leaching index.
- Of the total amount of 28.6 kg active ingredient per hectare, 26.8 kg is mancozeb. Special attention is required for the pesticides with this active ingredient.

9.2.7 Pesticide Control Mechanism

- More than 40 pesticides are officially registered for roses. Only one of these pesticides, Sec Saigon, was used by the growers of Me Linh Commune and Sapa. In almost all the cases growers use pesticides which are registered for other crops although the active ingredients of the registered brands are mainly the same as the active ingredients that were used; not for the production of roses. In fact they use illegal pesticides for the rose production.

9.2.8 Institutional framework for learning and innovation

- Information about pests and diseases is mostly provided on general crops; there is a lack of specific information about rose diseases and pests.
- Information about pests and diseases is mostly obtained from pesticides shop owners and meetings of pesticides companies organized by PPD. This explains why the focus is on pesticide use rather than on diagnose or disease prevention.
- The Agricultural University of Hanoi, the Plant Protection Department and the Plant Protection Research Institute provide the rose sector of Me Linh Commune with information on rose protection methods. However, this information is hardly perceived by the rose growers.
- AGI and the Plant Protection Department provide the rose sector of Sapa with information on rose production methods. However, this information is hardly perceived by the rose growers, and not considered relevant due to the lack of experience of these institutes with flower cultivation.
- Institutional information on pest control methods provided to growers is not specifically for rose production, but for horticultural activities.
- The most important selection criteria used by the different market segments for buying flowers, are: development of the bud, length of the stem, and color/ freshness of the leave.
- Residues of pesticides on the flower or the leave do not influence sales opportunities or sales price.

- Rose growers learn about new production methods throughout: other growers, pesticides shop owners and meetings of pesticides companies organized by PPD.
- The sector does not receive institutional support for the systemic development of more environmentally friendly production methods.
- The lack of institutional support rose growers receive to develop new cultivation or commercialization practices, limits the introduction of optimal process and product adjustments.
- The lack of institutional support to help small rose growers to introduce process and product innovations influences negatively the competitive position of roses coming from Me Linh Commune and Sapa and threatens the sustainable development of the sector in these regions.

9.3 Recommendations

- Neither the local nor the national government play an important role in providing farmers with information on sustainable rose cultivation. Since neighbours and pesticide shops are not always reliable and no independent sources of information, other ways of extension are required.
- There is a lot to win on pesticide use reduction by the implementation of elementary hygienic measures that contribute to a lower pest and disease pressure in the surroundings of the rose plots.
- The development of a pest control guide for farmers is recommended. This guide should contain information on (i) all pests and diseases occurring in the area, (ii) how to recognize them; (iii) all growth abnormalities not caused by pests or diseases; (iv) which IPM strategies can be followed; (v) which active ingredients are effective; (vi) which formulations contain this active ingredient (only formulations with clear and sound use instructions on the package should be mentioned) and (vii) for each solution a simple indication of the environmental and health risks should be given.
- The development of this guide and the related training should be a combined effort of crop protection specialists, IPM specialists, environmental scientists and extension specialists.
- The creation of a diagnose service in the production areas would be recommended, to assist growers in the determination of new, unknown or less commonly occurring diseases and to choose the right fighting method: physical control (plant removal), chemical control, instead of recurring to the trial and error method.
- Attention should be paid to the development of local varieties with special emphasis on pest and disease resistance. For this, awareness on illegal use of varieties needs to be created.
- Demonstrating and training growers in new, production increasing and environmentally friendly production methods (new ways of irrigation and fertilization, pruning and harvesting methods) is highly recommended.
- Training of growers in how to read the labels and symbols is recommended.
- Training of the growers in how to deal with waste is recommended.
- Training of farmers in understanding the importance of wearing protection clothes can improve the health situation of the growers.

- Training of growers and their family in safe storage is recommended.
- Training of growers on how to use pesticides in general is recommended and can improve the health situation for the growers. In Me Linh Commune and Sapa such trainings should pay specific attention to the use of Lanate 40SP (containing methomyl), Sec Saigon 50 EC and Visher 25 ND (containing Cypermethrin), Bumper 250 EC and Tilt 250 EC (containing propiconazole). In Me Linh commune also specific attention is required to the use of Mire Tox 10 WP (containing imidacloprid); In Sapa to the use of Bazudin (containing diazinon). Safe use training should focus on the use of safety equipment, safe storage, prevention and treatment of pesticide poisoning, disposal of containers, and regulation.
- Hazard estimations are based on pesticide parameters solely and do not take into account site specific aspects, such as climate, soil type and application practices. Based on the hazard assessment it can be observed that there is a potential environmental risk through the current use of pesticides in the rose production in Me Linh Commune and Sapa. Further assessment of the risks including mentioned site specific aspects is recommended.
- Some pesticides are not well known. The active ingredient is unknown or the effect on human health or the environment is unknown. Special attention is required for these pesticides or active ingredients. It is recommended to do more research to get the relevant information.
- It is unclear why the growers do not use the registered pesticides, especially because the registered pesticides often have the same active ingredients as the pesticides the growers use. Further research to understand this topic is recommended.
- Further analyses should be made on the direct linkages between the extension officer and the producer, the type of information they exchange and the effect that his suggestion has on the adjustments of production practices. Based on the information collected during this field work, one would get the impression that the information provided is mostly limited to pest control through pesticides use.
- A program on supporting the sustainable development of the rose sector managed by small rose growers, should be focused on:
    - Institutional strengthening on modern rose cultivation practices, integrated pest management, market trends, and sustainable chain development strategies.
    - Institutional strengthening on training small scale growers
    - Developing farmer field schools for rose growers.
    - Develop a better quality rose through improved post harvesting practices, and focus on direct sales in flower shops in Hanoi.
    - Development of a trade mark for quality flower with longer vase life.

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Appendix 1. Overview of pesticides, their AI and the WHO Class

Me Linh

Brand	*Active ingredient*	*WHO class*
Mancozeb 80 WP	Mancozeb	U
Forthane 80WP	Mancozeb	U
Score 250 EC	Difenconazole	III
Bumper 250 EC	Propiconazole	II
Sokupi 0.36AS	Matrine	Not found
Tri Tau (Local name, no package available)		?
Lannate 40 SP	Methomyl	Ib
Sec Saigon 50 EC	Cypermethrin	II
Tap ky 1.8 EC	Abamectin	Not found
Tilt 250 EC	propiconazole	II
Daconil 500 SC	chlorotalonil	U
Visher 25 ND	cypermethrin	II
Antracol	propineb	U
Mire Tox 10WP	imidacloprid	II
Pesticides sold by shopkeepers but not be mentioned by the growers		
Tilt supo (probably Tilt super 300 EC)	Difenconazole 150 g/l + propiconazole 150 g/l	III + II
Sherpa 10 EC; 25EC	cypermethrin	II
Anvil 5SC	hexaconazole	U
Cyperkill 25 EC?	cypermethrin	II
Di het	?	
So Ka	?	
Ofatox	fenitrothion	II
Ben cut	?	

Sapa

Pesticide branch	*Active ingredient*	*WHO class*
Alliette 80 WP 800 WG	Fosetyl aluminium	Fosetyl = U
Score	difenconazole	III
Bumper	propiconazole	II
Daconil	chlorotalonil	U
Tri tau	?	?
Lannate	methomyl	Ib
Sec Sai gon	cypermethrin	II
Sokupi	Matrine	?
Mancozeb	mancozeb	U
Tilt	propiconazole	II
Antracol	propineb	U
Forthane	mancozeb	U
Tap Ky	abamectin	Not found
Bazudin	diazinon	II

Appendix 2. Input data of active ingredients for calculating leaching to groundwater

	bron NMI/koc uit	*DT50 20C*	*T waarbij DT50 gewenst*	*DT50 25C*	*kom*	*Koc*	*Koc GUS*	*GUS*	*DT50water*
Abamectin	OSU	149	25	99.87768686		5000	5000	0.601899987	
Bazudin/diazinon	PAN	40	25	26.81280184		1581	1581	1.144199414	
Chlorotalonil	nmi	13.9	25	9.31744864	656		1131	0.917475865	2.5 uur
Cypermethrin	EU LOE	88	25	58.98816405		26000	26000	-0.73482023	
difenconazole			25	0				#NUM!	
Fenitrothion			25	0				#NUM!	
Fosetyl aluminium	PAN	0.04	25	0.026812802		325	325	-2.338810125	
imidacloprid	NMI	170	25	113.9544078	138		238	3.338944707	
mancozeb	NMI	0.23	25	0.154173611	584		1007	-0.809530057	
Matrine			25	0				#NUM!	
methomyl	NMI	16	25	10.72512074	37		64	2.260516959	
propiconazole	NMI	67	25	44.91144308	610		1052	1.615979148	
propineb	EU LOE	0.125	25	0.083790006				#NUM!	

Appendix 3. Input data of active ingredients for Primet

	bron	acuut LC50(ug/L) meest gevoelige soort *vis, daphnia, alg*	*class PAN*	*DT50 water (d)*	LC50 (mg/kg bw) *earthworm*
abamectin	NMI	10000	S	149	0.028
Bazudin/diazinon	PAN	0.47	V		
chlorotalonil	NMI	730	H	1.6	15
cypermethrin	EU LOE	0.3	V	3	> 100
difenconazole	PAN	150	H		
fenitrothion					
Fosetyl aluminium	PAN	360	H		
imidacloprid	NMI	1.1	V	73	0.0107
mancozeb	NMI	0.14	V	0.2	30
Matrine					
methomyl	NMI	0.56	V	4	2.1
propiconazole	NMI	1.5	V	57	0.686
propineb	EU LOE	40	V	heel klein	> 700

Appendix 4. An overview of the whole description on registration

1. Full-registration
Before a product can be registered in Vietnam, it has to be registered in another country. In which country is not important.
Fee:
Including PHI trial: 154.500.000 Dong
Without PHI trial: 118.500.000 Dong
Paper fee: 12.500.000

A. 1. Dossier submission:
- general data
- Analyze method
- name
- classification according to WHO

2. Application for registration
3. Label (name, etc,), label can only be finished after trials are finished.
4. 2 gram of analytical substance

According to Mister Hoi (PhD student of WUR) is besides this information a certification from another country necessary as well as an authorized letter from the mother company in another country.

A. is similar with the 'Admittance, application form and dossiers' step of figure X. The following additional information came from Dr. Dao Trong Anh.

Admittance, Application form and dossiers

This step is a very important step of the scheme.

For all requirements according to 'requirements for dossier of pesticide registration' information is required. The lists with requirements is diverse with information about physical-chemical aspects, analyze methods, human toxicity, MRL's, effects on environment, ecotoxicology and field trials.
The field trials will be done by the PCC. The other information has to be collected by the applicant. These can be original studies but it also can be a list of end points.

The PPD will check all the given information. This means they compare the given values with the values in the Pesticide manual, other guides and internet. If the values are comparable the dossier is complete.
Finally the values have to pass the criteria. The following criteria will be used by the PPD:

- *MRL's: The Codex system: FAO, WHO and the Codex Alimentarius Commission, Volume 2B - Pesticide residues in foods (maximum residue limits);*
- *Toxicity to organisms: Crop protection Handbook (USA)*

These criteria were mentioned during the interview. Probably there will be more criteria but this is not sure.

According to Dr. Dao Trong Anh 70% of the products will pass the criteria in this stage. 30% of the products will not pass the criteria and will be refuge.

A. If the dossier requirements are submitted and if they are complete → B

B. PPD: The PPD will give permission to the company to do field trials.

C. The company signs a contract on trials with the PPD (in fact the PCC, a department of the PPD, 70 people are working for the PCC according to Dr. Dao Trong Anh). The company pays the PPD to do the field trials on efficiency.

- 10 trials in 2 years for 2 crops in 2 regions.
- 5 trials (4 small scale (20-30 m^2) and 1 large scale (1000m2)) in North Vietnam
- 5 trials (4 small scale and 1 large scale) in South Vietnam

This takes about two years because the small scale trials has to be done first. After this it is allowed to test in large scale. The exactly time of the trials is depending on the crops to be tested.

The company will pay 50% of the amount before the trials and 50% after the trials. If the company has a good relationship with the PPD it will be possible to visit the fields during the trials.

Sometimes a second trial is required. This trial is required for tea, vegetable and fruit (so not for roses). This trials focuses on residue level on the crops

(PHI = Pre Harvest Interval: the time required to stop spraying before harvesting; if PHI > 7 days a product can not be registered). This trial is very expensive and includes again trails in the north and south of Vietnam (2 trials each).

D. After finishing the trials the results of these trials and the rest of the data according to the data requirements for the registration of a pesticide will go to the Technical committee. The other data which have to complete are descried in a list 'Requirements for dossier of pesticide registration'. These data contain general data, physical-chemical data, data about human toxicity, effects on animals etc. It is unclear if complete studies have to be submitted, it seems as if it is enough to present the values, like NOEC for fish = ….

Two times a year this Technical committee has a registration meeting. The following members are included in the Technical Committee:

- 4 members from de PPD (administration)
- 2 members from the Plant Protection Institute (research)
- 1 member from the Agricultural Technology Institute
- 1 member from the ministry of Agriculture
- 1 member from the Food research Institute

Between this members there is no specialist on human health or environment! There are no public criteria for environment. The government has his own (not public) environmental criteria, according to mister Dao,

The members of the Technical Committee will vote if a product can be registered or not. The product can be registered if 2/3 of the members agree. 90% of the products will pass this regulation system and will be registered.

According to Dr. Dao Trong Anh the procedure is as follows:

- *In stead of 9 members there are 13 members in the Technical Committee:*
- *3 members from de PPD (administration)*
- *2 members from the Plant Protection Institute (research)*
- *3 members from the ministry of Agriculture*
- *2 members from the ministry of Health*
- *1 member of the ministry of Environment*
- *1 member of the agricultural university*
- *1 member from the Fruit Institute*

There will be a voting; if 50% of the members agree the product can be registered.

E. Final decision for approval by Ministry of Agriculture

2. Supplementary registration: for label extension
Dossier submission: Description of the product
Two large scale efficiency trials have to be done for each label extension, one in the North and one in the south of Vietnam. For example, if the company wants to add two more crops on the label two trials have to be done with both crops.
Sometimes it is also necessary to do a residue trial (PHI).

The process for register is the same as for the full registration

Fee:
Including PHI trial: 59.200.000 Dong
Without PHI trial: 23.200.000 Dong
Paper fee: 5.200.000

3. Re-registration
Same crop, same target, same dose. After 5 years the product has to be re-registered. The applicant should be submitted to the PPD six months before the expiring date. The applicant has to show evidence that that the product is sold in the last 5 years.
The procedure is only paperwork, done by the PPD; the Technical Committee will not be involved.

Paper fee: 12.500.000?

4. Exceptional registration

The applicant has to give information about the crop. An efficiency trial is needed; but this can be done without the PPD. The applicant can make a contract with the university or the plant/crop protection department. One trial is enough. The PPD can make the decision for these kinds of registrations.