

**VIETNAM ACADEMY OF AGRICULTURAL SCIENCES
FRUIT AND VEGETABLE RESEARCH INSTITUTE**

REPORT ON PROJECT IMPLEMENTATION RESULTS

**Project title: “Strengthening Vietnamese SPS capacities for
Trade – Improving safety and quality of fresh vegetables
through the value chain approach”**

**ESTABLISHING SAFE VEGETABLE PRODUCTION
DEMONSTRATIONS IN COMPLIANCE WITH VIETGAP**

Division of Vegetable and Spicy Crop

Hanoi, July 2012

REPORT OF PROJECT IMPLEMENTATION RESULTS

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GENERAL INFORMATION

1. Project title: “Strengthening Vietnamese SPS capacities for Trade – Improving safety and quality of fresh vegetables through the value chain approach”

2. Implementing agency: Fruit and Vegetable Research Institute

3. Collaborating agencies:

- Department of Agriculture and Rural Development of Hung Yen
- Hai Hung JS High Quality Food Processing Company (HAVECO)
- Department of Agriculture and Rural Development of Lam Dong
- Thanh Nghia Cooperatives – Don Duong district – Lam Dong province
- Department of Agriculture and Rural Development of Son La
- 19/5 Agriculture and Services Cooperatives – Nong Truong Town – Moc

Chau district - Son La province

4. Location:

- Hiep Cuong commune – Kim Dong district – Hung Yen province
- Thanh Nghia Cooperatives Don Duong district – Lam Dong province
- 19/5 Agriculture and Services Cooperatives – Nong Truong Town – Moc

Chau district - Son La province

- Tu Nien village – Dong Sang commune Moc Chau district - Son La province

5. Report submitted by: Division of Vegetable and Spicy Crops (DVSC) – FAVRI

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PART 1. INTRODUCTION

Currently, markets are becoming more and more vegetable products with toxic substances due to the use of pesticides and chemical fertilizers, affecting consumers' health, causing confusion for consumers and reducing the vegetable consumption demand, causing impacts on the income of many vegetable growers. Information about food poisoning, including acute and chronic poisoning due to pesticides, nitrate, bacteria and heavy metals in our country in recent years has caused concern for consumers. Therefore, production of safe vegetables for consumers is the pressing issue.

Therefore, to survive products on the market with stable prices, as well as stable income from vegetables, vegetable products should meet quality and food safety requirements. In Vietnam, the vegetable production in compliance with VietGAP principles (Vietnam standards on safety, quality and traceability) is a new trend and is the right direction of many farmers.

Vegetable production in compliance with VietGAP principles always requires a tight management, requiring the recording of information from the stages of soil treatment, irrigation water source, fertilizer application, pesticides, pre harvest interval for fertilizers and pesticides, as well as intervals for storage, transportation and consumption of products so that products will be able to meet specified requirements for VietGAP certification. Production cost of VietGAP vegetable products is always higher than that of normal ones produced by traditional methods, thereby increasing values on the same cultivated area of vegetables and significantly contributing to income improvement for rural farmers. The VietGAP vegetable price is usually sold at double higher price than normal ones produced by traditional methods.

Being aware of the importance of vegetable production in compliance with VietGAP principles, in order to develop pilot demonstrations of safe vegetable production areas in compliance with VietGAP principles, training activities and demonstration establishment in the framework of the project ***"Strengthening Vietnamese SPS capacities for Trade – Improving safety and quality of fresh vegetables through the value chain approach"*** have been implemented in Hung Yen, Son La and Lam Dong provinces.

The Fruit and Vegetable Research Institute has collaborated closely with the Provincial Departments of Agriculture and Rural Development in Hung Yen, Son

La and Lam Dong and the beneficiary organizations such as Hai Hung JSC High Quality Food Processing (HAVECO), Thanh Nghia Cooperatives - Don Duong district - Lam Dong province, 19/5 Agriculture and Services Cooperatives – Nong Truong Town –Moc Chau district - Son La province, Tu Nhien village - Dong Sang commune - Moc Chau district - Son La province to implement activities of training of trainers and farmers and setting up the extension system. And so far, after a period of implementation, safe vegetable production and consumption situation in Hung Yen, Son La and Lam Dong has been good and highly appreciated.

Objective

In order to apply good manufacturing practices, good agricultural practices, good processing practices and respective standardized practical protocols to find appropriate methods to ensure the feasibility, practicality and ability to bring economic efficiency, thereby expanding the application of good manufacturing practices in vegetable growing areas of the project provinces

Specific objective

- Enhance Capacity and understanding about vegetable production in compliance with VietGAP
- Improve the quality and safety standards of 04 vegetable products including cabbage, cucumber, tomato (including cherry tomato and off season tomato) and chayote.
- Disseminate knowledge of GAP: Producing products meeting food hygiene and safety requirements, worker welfare, traceability and environmental protection.

PART 2. RATIONALE/OVERVIEW

2.1. Situation of vegetable and safe vegetable production in Hung Yen

Hung Yen is a province located in the heart of the Red River Delta of Vietnam. The province's administrative center is Hung Yen city, 64 km southeast from Hanoi city, 50 km southwest from Hai Duong city. It is bordered by Bac Ninh in the North, Hai Duong in the East, Hanoi in the West and Northwest, Thai Binh in the South and Ha Nam in the West. In the construction plan, this province belongs to Ha Noi.

With an area of 63,177 hectares of agricultural land, over 3,900 ha of water surface, ponds, lakes, ... the rural population of 0.9 million people accounting for 80% of the population of the province, Hung Yen agriculture land is getting narrower by industrialization and urbanization. However, agro-fishery production and rural economy of Hung Yen has had positive development focused on the exploitation and promotion of agro-ecological advantages of a province located in the heart of the Red River delta and the northern key economic sector.

In recent years, the shift in agricultural production has been towards the development of commodity production; cultivated area under annual crops as cash crops, vegetables and legumes and other commodity crops (flowers, ornamental plants, medicinal plants, ...), the area of perennial fruit crops, scales of livestock-poultry and aquatic products have been increased significantly.

Agricultural land use is getting more effective in the right direction: coefficient of land use increased from 1.87 times (1997) to 2.2 times (2001) and to date over 2.3 times. The planted area under vegetables and legumes cultivation in 2003 increased by 5.5% (while it was 7.75%/year in 1997-2001 period), short-term industrial plants and other cash crops such as herbs, flowers, ornamental plants, planting materials, ... stabilized and gradually increased. Particularly, planted area of food crops has tended to decrease (an average annual reduction of nearly 1%, of which food grain crops decreased by 1.1% / year). Water surface for aquaculture averagely increased by 8%/year. The "cumulative plot field change" was essentially complete in 98% of communes with 93.2% of rural households, initially taking effect in restructuring production. Land exploitation has been done in direction of expanding intensive cultivation and promotion of ecological characteristics in accordance with production conditions for each advantageous product in each sub-region. Income value per 1 hectare of cultivation is VND 35.2 million / year (2003), it was from VND 50 – over 100 million/ year, in many demonstrations.

Agricultural extension activities have been developed. In recent years, many new products, many crop and animal varieties, technical advances with high yield and quality, high economic value has been transferred to farmers in effective large scale production, increasing yield, productivity and quality of agricultural products, promoting the progress of economic restructuring in agriculture and rural areas

Recently, the functional bodies have actively invested in establishing safe vegetable demonstrations; training and guiding farmers to grow vegetables. Typically, Department of Science and Technology in collaboration with the Fruit and Vegetable Research Institute has supported farmers in this province to produce 23 ha of safe vegetables with 27 new and traditional vegetable species, to build net houses, nurseries, commercial vegetable production gardens, to send technical staff to monitor and guide growers in planting and harvesting process. My Hao, Kim Dong, Van Lam districts has invested and encouraged farmers to expand safe vegetable production As a result, concentrated vegetable growing areas have been established which have been expanded in many communes. However, some demonstrations, or projects of safe vegetable production haven't been multiplied. Under the action plan to ensure food hygiene and safety in Hung Yen province, the target until 2007 is that at least two regions in Hung Yen town and Pho Noi town will have safe vegetable selling shops and providers. However, there is no availability of safe vegetable selling shops. The registration to be certificated as the safe vegetable production areas is important to consume products, striving to build a brand for safe vegetables but no cooperative units have met the above requirements. A farmer in Dong Thanh (Kim Dong district) said that traders in Hanoi came to buy vegetable products directly on the field but at the cheapest price as it was a raw material without handling, safe vegetable certification. Meanwhile, many households do not comply with strict procedures of safe vegetable production; do not fully record the production process which is making difficult for contractors.

Hung Yen province has favorable conditions to expand the area under vegetables. Production of vegetables in the province per each harvesting crop reaches up to tens of thousands tons but with modest safe vegetables volume. Recently, public opinions and consumers have been worried, concerned about a variety of vegetables on the market using growth regulators, chemicals harmful to health, the problem of safe vegetable production has become more pressing. The fact showed that status of vegetable production is still worrisome. Most notably, the use of pesticides and fertilizers are indiscriminate. Currently, in our country, there are 270 types of

pesticides, 216 fungicides, 160 herbicides, and 26 growth regulators in use with increasing volume. Despite a variety of types, farmers usually use some familiar chemicals, even using highly toxic chemicals smuggled, such as Monitor, Wofatox due to risk averse. Pre Harvest Interval (PHI) has not been strictly abided, especially for vegetables harvested continuously as cucumbers, tomatoes, French beans. According to surveys, about 60% of respondents said their vegetable products marketed are harvested with PHI of 3 days. In some specialized vegetable areas in Yen My and Khoai Chau districts, farmers spray 7-15 times of 4-5 kg chemicals/ha for a cycle of growing cabbage. In addition, farmers also use pesticides to store vegetable seeds. Many farmers still apply non-decomposed/fresh manure and much nitrogen fertilizer for vegetable fields, which does not guarantee PHI, leading to high nitrate content in vegetable products.

Irrigation water source in many vegetable growing areas are being polluted by industrial chemicals, waste water. Even in some safe vegetables areas, water pollution is also worrying. At the Trung Nghia vegetable growing area (Hung Yen town), stages of planting, fertilizing, irrigation, harvesting all meet the technical requirements of safe vegetable growing protocols. However, when handling, vegetables are washed/cleaned in water tanks contaminated by bacteria.

2.2. Situation of vegetable and safe vegetable production in Son La

2.2.1. Natural conditions

Son La is a mountainous province with natural area of 14,174.44 km². Natural conditions facilitate Son La to have the potential for developing commodity and diversified agriculture.

Son La is located in heart of northwestern region; the provincial capital is Son La city, 320 km far from Hanoi. Its latitude and longitude is from 22⁰, 39' North; and from 103⁰11' to 105⁰02' East. It is bordered with Lai Chau and Yen Bai in the North, Thanh Hoa and Lao PDR in the South, Hoa Binh and Phu Tho in the East, Dien Bien in the west . Son La is based in Highway No. 6 (Hanoi - Son La - Dien Bien), these are arteries, significant in economic and political connections between the North West and Hanoi as well the Northern delta provinces.

Climatic conditions

Son La is located in a tropical monsoon climate, continental in nature, influenced by topography.

Characteristics of climatic conditions in Son La is high rainfall, the total high temperate, moderately cold winters, are favorable conditions for various types of

tropical and subtropical plants to develop. Moc Chau plateau offers a cool temperate climate suitable for many psychrophilic temperate crops. Areas along Da River have hot and humid climate suitable for growing tropical plants ... The advantage of this province is to produce temperate fruit and vegetable crops in cold winter that are impossible in Southern provinces

Topography

The terrain is very complex, heavily dissected with steep slope. The altitude is about 600 – 700m above sea level. The province has three major mountain systems: The left bank of the Da River mountain system, the right bank of Ma River mountain system and mountain system alternating between Da and Ma. Most of the mountains and rivers in this province is lower from the northwest - southeast. More than 97% of natural area belongs to the basin of Da and Ma Rivers. Interspersing between the mountains is the basin valley. Arable land is often narrow, with steep slopes. The province has Moc Chau Plateau and Na San Plateau. Son La is relatively flat, convenient for the development of industrial crops, vegetables, perennial fruit trees and breeding cattle.

Water resources

Water resources of Son La are plentiful, abundant, but due to uneven distribution of water resources, to exploit and use water resources, it is needed to construct irrigation works to cater to the demands of production and life, which requires a huge investment.

Land resources

Mai Son, Yen Chau, Moc Chau, Phu Yen districts and Son La City has a variety of soil types, but the land has the potential viability of vegetables mainly on the soil types: “py”, “RDV”, “FV”, “FV”, “FI”, “D”.

Current situation of land use

The status of land use in 2010 as follows:

Total natural area: 1,417,444 ha, of which:

- Agricultural land: 888,412 ha, accounting for 62.68% of natural area, including:
 - + Land for agricultural production: 261,439 ha.
 - + Forest land: 624,381 ha.
 - + Land for aquaculture: 2452 ha.
 - + Another 140 hectares of agricultural land.
- Non-agricultural land: 63,600 ha, accounting for 4.49% of the natural area.

- Unused: 465,431 ha, accounting for 32.84% of the total natural area (hilly land which was not used: 420 160 ha)

Table 1. Current Situation and variation of land use in Son La in 2010

No	Criteria	Code	Total area (ha)	Percentage (%)
	Total natural land		1,417,444	100
1	Agricultural land	NNP	888,412	62.68
1.1	Agricultural Production Land	SXN	261,439	
1.1.1	<i>Annual cop land</i>	<i>CHN</i>	<i>22,011</i>	
1.1.1.1	Paddy land	LUA	37,270	
1.1.1.2	Weed land for animal raising	COC	1,771	
1.1.1.3	Other annual crop land	HNK	186,970	
<i>1.1.2</i>	<i>Perennial crop land</i>	<i>CLN</i>	<i>35,428</i>	
1.1.2.1	Perennial industrial crop land	LNC	12,046	
1.1.2.2	Perennial fruit crop land	LNQ	21,833	
1.1.2.3	Other perennial crop land	LNK	1,549	
1.2	Forestry land	LNP	624,381	
<i>1.2.1</i>	<i>Productive forest land</i>	<i>RSX</i>	<i>178,920</i>	
<i>1.2.2</i>	<i>Protective forest land</i>	<i>RPH</i>	<i>397,345</i>	
<i>1.2.3</i>	<i>Specially use forest land</i>	<i>RDD</i>	<i>48,115</i>	
1.3	Water surface land for fishing	NTS	2,452	
1.4	Other agricultural land	NKH	140	
2	Non – agricultural land	PNN	63,600	4.49
3	Unused land	CSD	465,431	32.84
3.1	Unused flat land	BCS	-	
3.2	Unused mountainous land	DCS	420,160	
3.3	Non tree rocky mountains	NCS	45,271	

Source: Department of Natural Resources and Environment of Son La province

Human resources

In recent years, the quality of labor in Son La have been gradually improved, educational level of the workforce is getting enhanced. Illiterate and high school non – graduated labor rate has been decreased; the number of employees graduated from secondary and high schools is increasing.

Number of employees trained has steadily increased over the years, by 2010 the trained employment rate accounted for 20%. But most of the trained workers focus in cities and district capitals.

2.2.2. Current situation of safe vegetable production in Son La province

According to statistics, the share of agriculture, forestry and fisheries in GDP in the province got decreased from year to year, this figure was 50.81% in 2005, 40.01% in 2010. Similarly, in agriculture, the proportion of cultivation got gradually decreased which the proportion of the value of cultivation was 80% in 2005, and 70.85% in 2010.

Table 2. Vegetable gross output and gross output structure in cultivation sector

No	Items	2005		2010	
		Value (million VND)	Structure (%)	Value (million VND)	Structure (%)
	Gross output of agriculture	2,447,443.00	100.00	7,191,588.00	100.00
	Of which cultivation	1,957,859.00	80.00	5,095,550.00	70.85
	Vegetables and legumes	116,339.80	5.94	463,642.80	9.10
I	Vegetable crops	104,167.30	5.32	430,671.60	8.45
1	Leafy vegetables	50,122.00	48.12	146,723.00	15.70
	Brassica	28,610.00	1.50	86,641.80	1.70
	Kangkong	8,125.50	3.00	26,133.10	6.10
	Cabbage	13,386.50	12.90	33,948.10	7.90
2	Root and tuber vegetables	13,140.10	12.61	29,410.90	45.80
	Kohlrabi	10,030.50	17.80	26,341.00	39.70
	Potato	3,109.60	16.00	3,069.90	6.10
3	Fruity vegetables	5,736.10	5.51	16,656.00	17.70
	Tomato	4,992.10	4.80	9,617.70	2.20
	Cucumber	744.00	27.50	7,038.30	15.50
4	Spicy cops	16,625.00	15.96	66,778.70	0.70
5	Other vegetables	18,544.10	17.80	171,103.00	36.90
II	Legumes	12,172.50	0.12	32,971.20	0.65

Source: Statistical Department of Son La

In 2010, gross output of vegetable and legume crops in the whole province reached VND 463.642 billion, accounting for 9.1% of total gross output of cultivation sector; while this proportion in 2005 was 5.9%.

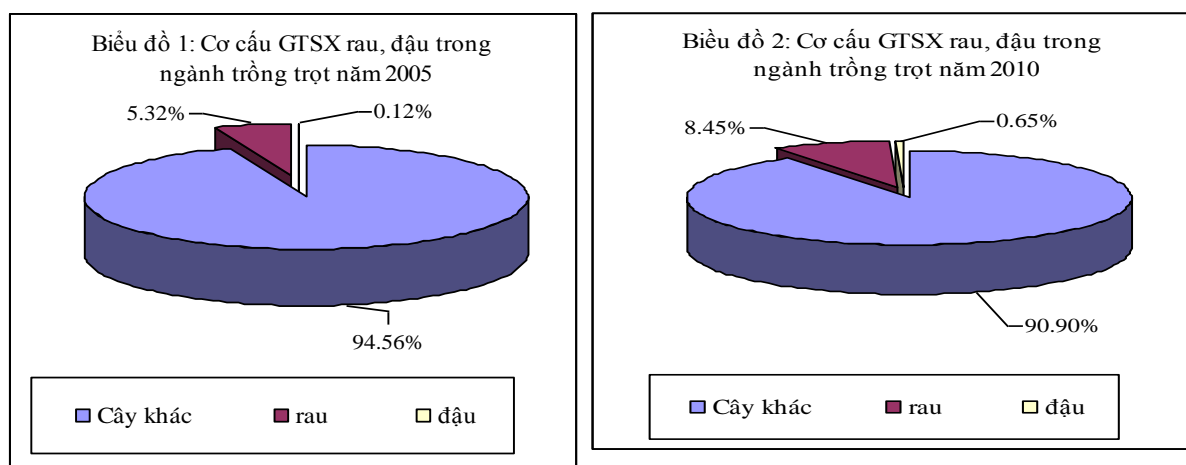


Figure 1: Structure of vegetable and legumes gross output in 2005-2010

In the period 2005-2010; growth rate of gross output of cultivation sector was 8.85%/year, while vegetable gross output grew 10.58%/year, of which spicy group had the highest growth rate of 14.2%/year, which it was 2.88%/year for legumes.

Table 3. Growth rate of vegetable gross output in 2005-2010 (at constant 1994 prices)

No	Item	2005 (million VND)	2010 (million VND)	Growth rate (%/year)
	Gross output of agriculture	1,346,301.00	2,209,500.00	10.42
	Of which Cultivation	1,118,824.00	1,709,661.00	8.85
I	Vegetable crops	42,722.40	70,635.80	10.58
1	Leafy vegetables	20,550.30	23,316.30	2.56
	Brassica	8,440.00	10,432.40	4.33
	Kangkong	5,417.00	4,892.00	-2.02
	Cabbage	6,693.30	7,991.90	3.61
2	Root and tuber vegetables	8,982.20	6,449.80	-6.41
	Kohlrabi	5,602.20	4,952.30	-2.44
	Potato	3,380.00	1,497.50	-15.03
3	Fruity vegetables	3,636.80	4,764.30	5.55
	Tomato	2,892.80	2,224.30	-5.12
	Cucumber	744.00	2,540.00	27.84
4	Spicy cops	4,156.30	8,088.50	14.24
5	Other vegetables	5,397.00	28,017.00	39.01
II	Legumes	7,079.40	8,158.50	2.88

Source: Statistical Department of Son La

Production of vegetables and legumes not only supplies vegetable products, employment, income improvement, but also contributes to change of economic structure of cultivation sector.

Current situation of vegetable production

In period of 2005-2010, area of vegetables and legumes increased to 1,404 ha, achieved growth rate of 7%/year. In 2010, this figure was 4,918 ha of which concentrated in Moc Chau (1,079 ha), Muong La (600 ha), Mai Son (594ha), City of Son La (569 ha),...

Table 4. Area, yield and production

Unit: Area: ha; Yield: quintal/ha; Production: ton

No	Districts, Cities	2005			2010		
		Area	Yield	Production	Area	Yield	Production
1	Son La City	313	144	4,500	569	120	6,830
2	Phù Yên	511	85	4,324	475	140	6,659
3	Mộc Châu	373	147	5,463	1,034	184	19,057
4	Yên Châu	290	175	5,071	453	178	8,045
5	Mai Sơn	569	116	6,587	594	80	4,757
1	Quỳnh Nhai	252	20	491	261	27	697
2	Thuận Châu	330	207	6,830	397	188	7,452
3	Mường La	357	132	4,724	600	166	9,936
4	Bắc Yên	193	83	1,596	231	102	2,356
5	Sông Mã	227	63	1,422	215	71	1,535
6	Sốp Cộp	99	60	598	89	61	545
	Whole Country	3,514	118.4	41,606	4,918	138.0	67,869

Source: Statistical Department of Son La

Average vegetable yield in the province in 2010 reached 138 quintal/ha, some districts that have quite high yield as Moc Chau (184.3 quintal/ha), Thuan Chau (187.7 quintal/ha), Yen Chau (177.6 quintal/ha), Muong La (165.6 quintal/ha), etc; If compared with 2005, vegetable yield in the whole province increased by 3.3%/year. The reason of increased average vegetable yield during 2005 - 2010 is mainly due to application of intensive cultivation, technical advances in terms of breeding techniques, farming techniques, combined with the experience of farmers accumulated during production process.

Production of vegetables in the province in 2010 reached 67.8 thousand tons, increasing by 26.2 thousand tons compared to 2005, equivalent to 10.3%/year. Mean capita vegetable consumption in 2005 and 2012 was 40 kg/year and 62kg/year, respectively which is lower than the mean capita vegetable consumption of the whole country (130kg/year).

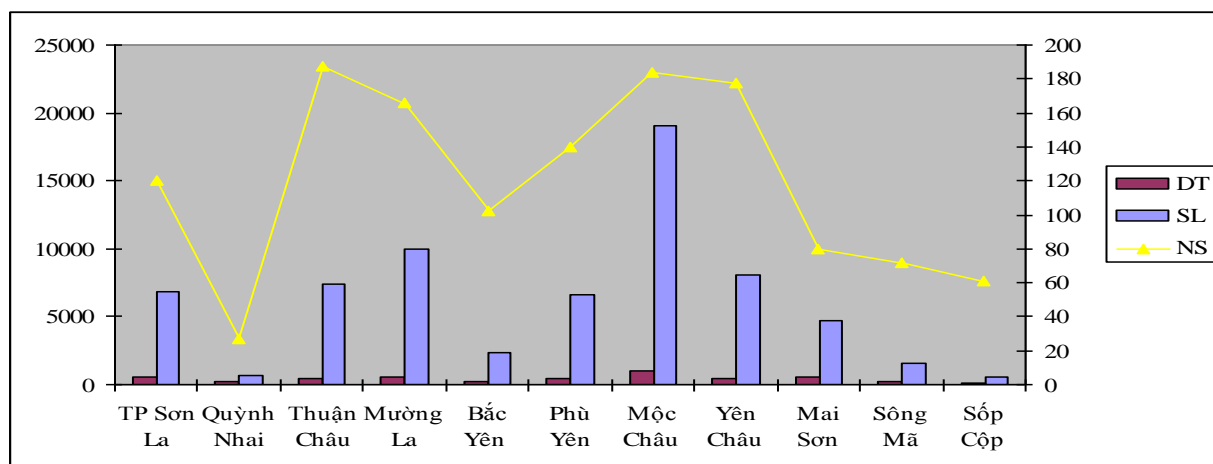


Figure 2: Area, yield and production of vegetable crops in Son La in 2010

Current situation of vegetable production in project site

Table 5. Scale of vegetable area by district

(Period of 2005-2010)

Unit: Ha				
No	Item	2005	2010	Growth rate (%/year)
	Total area	2.056	3.125	8.7
1	Sơn La City	313	569	12.7
2	Mai Sơn district	569	594	0.9
3	Yên Châu district	290	453	9.3
4	Mộc Châu district	373	1034	22.6
5	Phù Yên district	511	475	-1.5

Source: Statistical Department of Sơn La

- The cultivated area of vegetables in 2010 in the project districts reached 3,125 hectares, accounting for 64% of the province and with growth rate of 8.7% /year, that is higher than the average of the province. Mộc Châu is the district that has the largest area under vegetable cultivation (1,079 ha), Mai Sơn (594 ha), Sơn La City (569 ha).

Table 6. Vegetable yield by district (Period of 2005-2010)*Unit: Quintal/ha*

No	Item	2005	2010	Mean increase (%)
	Mean yield	126.2	145.1	2.8
1	Son La City	143.8	120.0	-3.5
2	Mai Son district	115.8	80.1	-7.1
3	Yen Chau district	174.9	177.6	0.3
4	Moc Chau district	146.5	184.3	4.7
5	Phu Yen district	84.6	140.2	10.6

Source: Statistical Department of Son La

- The average vegetable yield of five districts in project site in 2010 reached 145 quintal/ha, that is 7 quintal/ha higher than average vegetable yield of the province (in 2010 mean vegetable yield in the province reached 138 quintal/ha). Districts that have quite high yield include Moc Chau (184.3 quintal/ha), Yen Chau (177.6 quintal/ha). The reason of increased average vegetable yield during 2005 - 2010 is mainly due to application of intensive cultivation, technical advances in terms of breeding techniques, farming techniques, combined with the experience of farmers accumulated during production process.

- Production of vegetables was 25.9 thousand tons and 45.3 thousand tons in 2005 and in 2010, respectively, with the growth rate of 11.8%/year in the period 2005-2010.

Vegetable production in Son La project site has gradually established some specialized vegetable production areas with relatively large-scale near urban areas, cities, towns, industrial centers, such as in Chieng Coi, Chieng An and Chieng Sinh (Son La City), Chieng Pan, Chang Dong (Yen Chau District), Moc Chau Farm town, Muong Sang, Sang Dong, Chieng Hac, Phieng Luong, Van Ho,...

These specialized vegetable production areas provide goods for market in the province, mainly Son La city, the neighboring district capitals. The production and consumption is entirely operated by market mechanisms. Due to improper structure of vegetable types and growing seasons, there is still occurrence of insufficient vegetable volume before main season.

Table 7. Production of vegetables by district (period of 2005-2010)*Unit: Ton*

No	Item	2005	2010	Mean increase (%)
	Total	25.945	45.348	11,8
1	Son La City	4500	6830	8,7
2	Mai Son district	6587	4757	-6,3
3	Yen Chau district	5071	8045	9,7
4	Moc Chau district	5463	19057	28,4
5	Phu Yen district	4.324	6.659	9,0

Source: Statistical Department of Son La

In addition to providing vegetables for the market inside the province, vegetable production in this region also partly provide for nearby provinces (Lai Chau, Dien Bien, Hanoi). This region has many favorable conditions for investment into the planning of safe vegetable production with high quality. The application of scientific and technical advances in vegetable production have been implemented by a number of enterprises in Moc Chau with new technology, small scale, such as shelter, sprinkling, fertilization, ... which have initially been highly effective

Structure of vegetable and legume season

- Structure of season: in the period 2005 - 2010; planted area of vegetable crops in winter-spring is higher than summer – autumn

Vegetables and legumes are grown mainly in winter-spring due to:

+ Climatic conditions are suitable for variety of temperate vegetable species with high economic value, abundant land source and favorable market

+ Along with the progress of science and technology, many new vegetable varieties with high yield and quality, adapted to high temperatures have been imported and successfully tested in Vietnam as heat-tolerant cabbage, cucumber, tomato ... thereby making seasonal structure change. Many crops such as cabbage can be grown in winter – spring and summer autumn rather than only grown in winter-spring previously. So the percentage of vegetable area in summer autumn has been increasing.

Table 8. Seasonal Structure of vegetables and legumes

Unit: %

No	Item	Winter – spring season		Summer – autumn	
		2005	2010	2005	2010

1	Son La City	63.4	68,5	36,6	31,5
2	Mai Son district	80.7	79.4	19.3	20.6
3	Yen Chau district	40.4	33.2	59.6	66.8
4	Moc Chau district	81.2	76.9	18.8	23.1
5	Phu Yen district	84.0	83.5	16.0	16.5
	Total	58.2	59.6	41.8	40.4

Source: Statistical Department of Son La

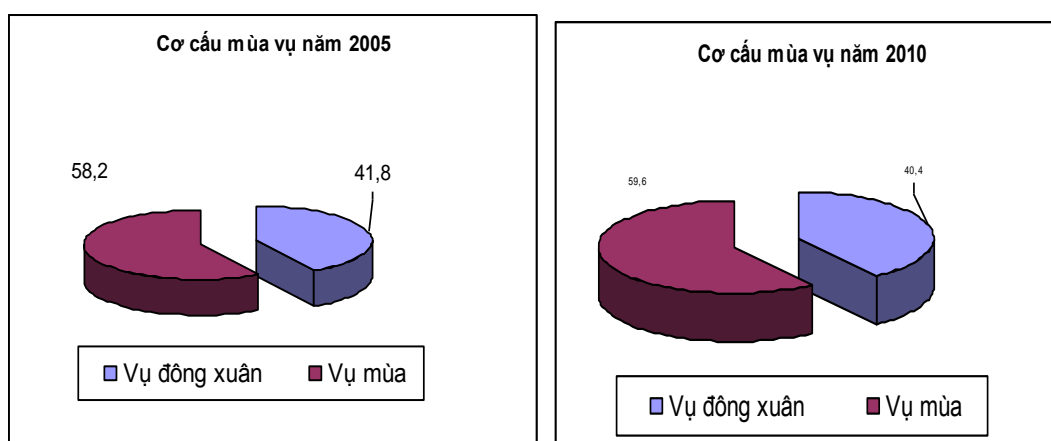


Figure 3: Seasonal Structure of vegetables during 2005-2010

Main vegetable species

In the period 2005 - 2010, some vegetables remarkably varied in terms of structure in cultivated area due to market and consumer demand, vegetable area increased by from 59.9% (2005) to 67.5 % (2010), cucumbers from 2.2% in 2005 to 3.03% in 2010, tomatoes from 1.5% in 2005 to 1.62%/year

- Restructuring area of some major vegetables: some vegetables such as potatoes decreased by from 1.3% in 2005 down to 0.8% in 2010, cabbage from 11% down to 9.2%, tomato from 4.8% down to 3.5%, cucumbers from 1.1% in 2005 up to 2.9% in 2010, vegetables increased by 20.9% in 2005 to 44.2% in 2010.

Vegetables grown in the province are very abundant but the vegetables with large areas in Son La are mainly temperate species, it is mainly grown in winter-spring crop. Cabbage, kohlrabi, tomatoes, onion, garlic, potatoes, herbs, ... are mainly grown in winter-spring (70-99%). It can be seen that, many vegetables can be grown in summer – autumn season but with small volume which need to be increased in the future.

In the project site, some specialized vegetable areas have established vegetable demonstrations or vegetable crop rotation with other crops which bring very high income. Many demonstrations have been applied in production for many years, confirming its sustainability and developing in a relatively large scale. Some demonstrations with high economic efficiency have a high economic efficiency are

(1). On specialized vegetables and industrial crops:

- Cropping system of specialized chayote – H'Mong green Mustard in Van Ho - Moc Chau, garlic in Chieng Dong - Yen Chau total income of VND 90-110 million/ha, net return of over VND 60-70 million/ha/ year

- Cropping system of wax gourd - pumpkin - brassica - cauliflower (cabbage, kohlrabi ...): This formula is popularly used in Phu Yen district with an average total income of VND100 million/ha/ year and net return of VND 70-80 million/ha/year.

- Cropping system of green mustard - tomato – yard long bean – H'Mong green mustard are applied in the Moc Chau and Yen Chau districts with total revenues of VND120 million/ha, and net return of VND 80-100 million/ha/year.

2). Vegetable cultivation in paddy land

- Cropping system: summer – autumn rice season - tomato – wax gourd.

- Cropping system: tomato - summer – autumn rice season - cucumber.

- Cropping system: Spring rice - pumpkin - 2 seasons for brassica

- Cropping system: Garlic - summer – autumn rice season - cucumber – cabbage

- Cropping system: Garlic - summer maize- winter vegetables

- Cropping system: Vegetables (Spring) - summer – autumn rice season - vegetables (winter which is popularly applied in Son La. Winter vegetable types are grown according to custom, market tastes. Number of plant harvesting times depends on vegetable species and intensity of each region, each household.

Vegetable storage and processing

Post harvest handling is undeveloped. Most of the Son La vegetable products after harvesting is carried straight out market. After harvesting the vegetables are not processed, not preserved so quickly damaged, crushed. So the value obtained is not high, even to throw away if not sold promptly.

According to MARD, processed vegetable products account for only about 10% in Vietnam. The remaining 90% is without processing, but fresh consumption. No statistical data has been obtained in Son La, but according to the results of preliminary investigation, vegetables are usually consumed fresh, unprocessed.

2.2.3.Current status of safe vegetable production in project site

In recent years, production and consumption of safe vegetables in this province has been gradually paid more attention to through the demonstrations, projects and programs. Every year, there are technical training courses on safe vegetable production techniques in the province site. However, up to date, safe/VietGAP vegetable area certificated is not much, initially implemented only in some regions in the form of small scale demonstrations and developed primarily in the area of Moc Chau, Mai Son districts as follows:

+ Moc Chau District: Compared to the districts along Highway No.6, Moc Chau has very favorable climatic and land conditions for growing vegetables year round. Many vegetable farmers in the province have been trained on safe vegetable production protocols, mainly in Dong Sang and Muong Sang, Chieng Hac, Chang Luong, Van Ho, Farm Town. Key vegetable species grown in Moc Chau district is chayote (the area accounted for 51.48% of the vegetable area in 2010; 47.43% in 2011), and also some other products such as pumpkin, tomato, H'Mong green mustard, kohlrabi, cabbage, cucumber, brassica ... But up to date, safe vegetable area certificated in compliance with VietGAP standards is only 6 hectares in Hoang Tuan Cooperatives in Van Ho commune.

In Moc Chau district, there is a high-tech agricultural – industrial zone with the area of 20 ha, mainly producing high quality flowers, and high-tech produced vegetables in the form of demonstrations such as watermelon, cabbage, tomato ... by using mulching films with farm size of about 3 ha and double higher yield than conventional vegetable production

Implementing measures to apply safe vegetable production protocols

- For safe vegetable production protocols

So far, the Ministry of Agriculture and Rural Development has issued seven safe vegetable production protocols for cabbage, cucumber, French bean, tomato, yard long bean, baby maize, 01 protocol of integrated pest management in safe crucifereous vegetables production and 01 standard for organic agricultural production and processing. VietGAP "Good Agricultural Practices" for the fresh fruits and vegetables in Vietnam has been issued based on Decision No. 379/QD-BNN-KNCN on 28/01/2008

- Implementing measures to apply safe vegetable production protocols in Son La

The traditional production methods are mainly applied, not many households use IPM methods IPM in production.

- + Unsafe fertilizer: Many households still use fresh/non – decomposed manure, compost; unbalanced and much application of chemical fertilizers, especially urea
- + The abuse of pesticides is occurred and PHI is not ensured
- Producers have not been paid much attention to preserving water quality. The investigation results in some areas in this province indicated that people indiscriminately dump rubbish and waste around water reservoirs/tanks, at the same time, use water inside the reservoirs to wash vegetables, ... leading to affected water quality
- The collection of pesticide containers have not been taken seriously, adversely affect the surrounding environment.

To switch to production of safe vegetables, farmers need to make/comply the complete safe vegetables production protocols, gradually invest infrastructure to support the production protocols and eventually to produce based on the advanced technology to provide safe vegetable products, lower costs and meet increasing demand of consumers both in quality and taste/preference.

Types of organizing production

- a. Household economy: current vegetable production type is mainly households and small-scale area with small scale of 200 to 500 m², large scale of 1000-3000m² by only some households. With the small mean size of land area per household, it is hard in organizing production and consumption.
- b. Farm economy: as of December 31, 2010, there have been 114 farms, of which 5 farms producing annual plants: of which there is a farm with 9 ha -scale in Moc Chau, and 3 ha green houses for growing flowers, fruits and vegetables
- c. Cooperatives economy: currently there are 83 agricultural cooperatives in Son La, of which three cooperatives are involved in the production and consumption of safe vegetables (19/5 Agricultural & services Cooperatives; Hoang Tuan Cooperatives and Tropical Flower Joint-Stock Company all based in Moc Chau district

Types of organizing safe vegetable distribution

- Type of household

Organizing vegetable distribution in Son La is mainly done by farmers themselves from production to distribution

Vegetable production in Son La province is heavily spontaneous with simple trading types and difficult quality management. Farmers distribute their vegetable products under the following forms:

- + Producers themselves bring their products for sale: products are mainly sold in local markets, wholesaled and retailed in the city, towns (about 70-80% of total production of vegetables).

- + Selling in the field: harvested products are sold on farm, accounting for about 10%.
- + Wholesale: a number of collectors fathers farmers products to distribute in neighboring provinces such as Hanoi, Hoa Binh, Lai Chau ... accounting for about 10-15%.

Prices of vegetable products are not stable: investigation results showed that the price is generally higher in early and late season (up 1.5 - 2 times higher the price than in main season). Prices between safe vegetables and traditional vegetables did not have much difference.

- Type of cooperatives and enterprises

Basically, production is done by farmers, but the distribution of products is done by cooperatives via contracting with buyers and negotiating the proper prices, quality and time of delivery of products. Harvested vegetable products are usually handled at a higher level compared to household size. Currently, in Moc Chau, there is a number of enterprises contracting for vegetables (especially off season vegetables). Distribution of Son La fresh vegetables in the shops in Hanoi including as the system of F-Mart stores by FDC technology Corporation in five supermarkets: Linh Dam, Dinh Cong, Trung Hoa - Nhan Chinh, My Dinh. This type has several advantages because the producers and cooperatives have been linked together through the forms of production contract.

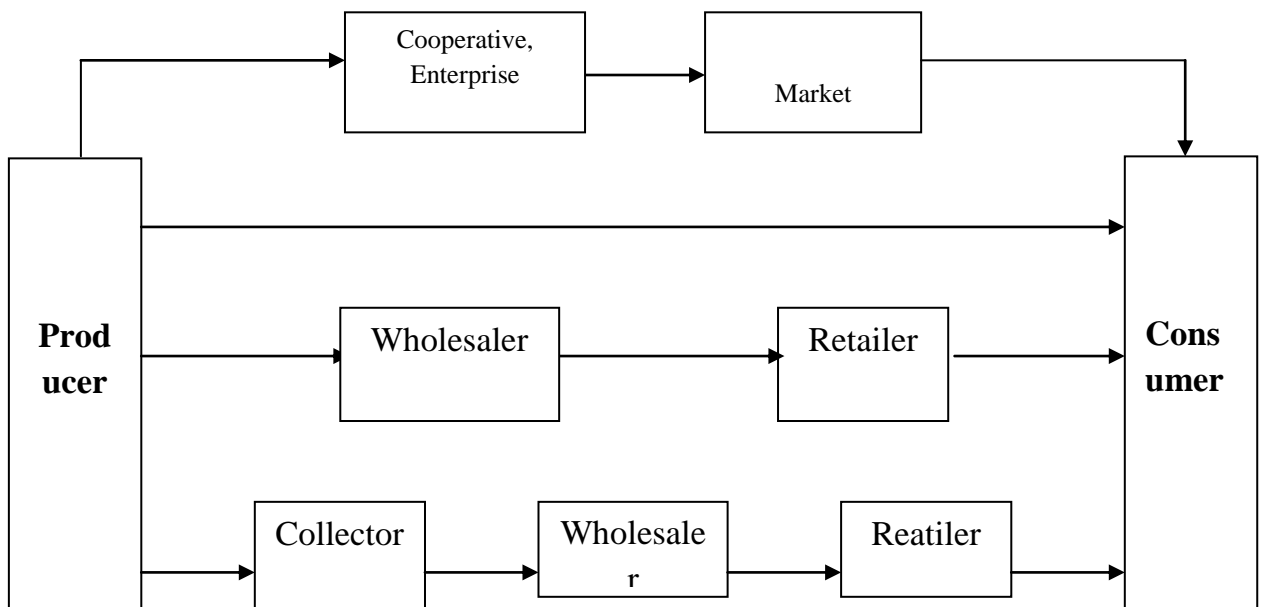


Figure 4: Vegetable supply chains

Agricultural extension activities of establishing safe vegetable production demonstrations

- In 2006 Provincial Extension Center began establishing demonstrations in the direction of safe vegetable production, at a small area of approximately 1-2 ha in Yen Chau, Moc Chau, Son La City, Mai Son.
- In five districts of project site, there are demonstrations of Agricultural Extension Centre. Demonstration establishment is always combined with training farmers involved in including:
 - + Training combined with demonstrations
 - + Training as required
 - + Training as TV program
 - + On spot training
- Annual budget for training is an average of VND 200 million from National provincial budget resources. Extension workers at commune level train 300people/year.
- In 2011, some demonstrations at 2 ha scale for tomato was established in Mai Son and at 4ha scale for cauliflower in Son La city.
- In 2012, the estimated budget of about VND 500 million is used for establishing demonstrations of safe vegetable production in compliance with VIETGAP: which is expected in establish concentrated vegetable production demonstrations in Long Luong - Moc Chau at 10 ha scale for chayote and H'Mong green mustard.

*** GENERAL ASSESSMENT**

- Despite increased vegetable area and production in Son La, its yield and quality is still low with spontaneous development, unstable species.
Vegetable varieties with high yield and quality are not many, with improper intensive cultivation protocols, low yield, not high quality and food hygiene and safety.
Actions to develop new food vegetable varieties have primarily paid attention to yield and production without information of market demand as well food hygiene and safety of products.
- For storage, processing and distribution of products
In Moc Chau, there is unavailability of any processing enterprises. The establishment of sales network of fresh vegetables in this province is spontaneous

without planning transportation systems, processing, sorting, packaging, sales and marketing to expand the market.

Fruit and vegetable safety and quality inspection and control has not been systematic yet, due to but lacking the institutional and technical facilities and modern equipment in quality control as well as qualified professional staff.

Storage technologies, such as using ozone, biological products, cold storage have not been disseminated, thereby not establishing a system from harvesting to retail outlets.

- The policies, institutions and operation organization

Implementation of Decision No. 80-CP on encouraging sales of farm produce via contracts is still inadequate. Linkage of scientists, extension staff, traders and farmers in horticultural industry is loose, without proper binding in term of economic benefits between enterprises and farmers.

The coordination between central and local levels, between localities with enterprises is not very good in developing materials and processing.

Investment capital for infrastructure is deficit. The provincial budget is limited to support enterprises and farmers.

- Difficulties and constraints in the development of safe vegetables

+ There is no plan to allocate land for intensive farming areas with large enough scale and infrastructure investment for production of safe vegetables (irrigation systems, greenhouses, electricity, transportation ...).

+ Safe vegetable production in recent years in Son La is spontaneous, with small-scale; moreover, farmers are not further updated to the production requirements of safe vegetable production.

+ No availability of a system of production, collection, preservation and distribution to ensure safety for producers and reliability for consumers.

+ Market instability, lack of systems for safe vegetable shops in the province, there is no certificate grant by management bodies, not developing a brand of safe vegetables of Son La province.

2.3. Situation of vegetable and safe vegetable production in Lam Dong province

Agricultural production in Lam Dong has formed specialized concentrated areas of based on different ecological sub-regions and promoting the comparative advantages of industrial crops, vegetables and flowers in a large scale and crop

quality is getting increasing, meeting the demand for raw materials of processing industries and markets. Structure of gross output of agriculture accounts for 50% of the economy of the province, the gross output per area unit per capita in 2010 reached over VND 70 million/ha

Table 9: Data of vegetable production and export of Lam Dong province

Item	2005	2006	2007	2008	2009	2010
1. Area (ha)	29,378	35,197	35,055	39,789	43,202	43,598
Production (tons)	748,111	911,124	933,895	1,128,365	1,243,918	1,296,424
2. Export turnover						
Volume (tons)	13,764	15,240	10,696	9,030	13,562	13,500
Value (USD)	12,588	10,375	12,303	10,515	14,406	12,500

Source: Statistical Year Book of Lam Dong 2006-2010 and Estimation of 2010 plan completion of Agriculture and Rural Development Sector.

Lam Dong is a province with the unique specialized vegetable growing region compared to the country. Vegetable area in Lam Dong is getting increasing and expanded, especially in the districts surrounding Da Lat city (Table 2, Table 3). There are currently more than 20 types of high quality different vegetables grown in Lam Dong which were introduced from USA, Japan and France. Diversity, specialization of crops with the use of high dose pesticides/chemicals has made vegetable pests more diverse, occurring annually and causing great damage to farmers.

Due to availability of land and suitable climatic conditions, many high quality vegetable species can be grown year round range for the domestic market and export. The domestic market of Lam Dong vegetables is Ho Chi Minh City accounted for 60-70%, the southern and central provinces accounted for 30-40%. Export markets mainly are countries: Japan, Singapore, South Korea and Taiwan, ... annual exported volume of from 8,042 to 15,240 tons.

Table 10: Vegetable area by districts, cities by years

Location	2000	2005	2006	2007	2008
Total	18.879	29.378	35.197	35.055	39.789
1. Da Lat City	6,232	7,466	9,271	8,257	8,377
2. Bao Loc town	37	42	42	45	49
3. Dam Rong district	-	104	110	141	142
4. Lac Duong district	321	863	2,103	2,084	2,502
5. Lam Ha district	506	651	741	831	943

6. Don Duong district	7,676	11,490	12,550	12,925	16,283
7. Duc Trong district	3,666	7,865	9,403	9,849	10,224
8. Di Linh district	60	130	135	137	168
9. Bao Lam district	54	151	148	132	169
10. Da Huoi district	76	49	114	118	141
11. Da Teh district	129	302	304	302	459
12. Cat Tien district	122	265	276	234	332

Source: Statistical Department of Lam Dong

Table 11: Vegetable production by districts, cities by years in Lam Dong

Location	2000	2005	2006	2007	2008
Total	432,364	748,111	911,124	933,895	1,128,365
1. Da Lat City	158,649	191,695	234,277	203,439	211,336
2. Bao Loc town	246	253	249	264	288
3. Dam Rong district	-	925	1,013	1,342	1,396
4. Lac Duong district	3,873	17,154	44,599	45,217	60,724
5. Lam Ha district	5,863	7,277	8,901	10,380	11,746
6. Don Duong district	171,488	298,404	355,750	368,928	508,167
7. Duc Trong district	88,005	220,601	253,619	290,774	313,803
8. Di Linh district	547	1,130	1,174	1,176	1,462
9. Bao Lam district	537	940	881	1,104	1,439
10. Da Huoi district	664	691	2,248	2,124	2,818
11. Da Teh district	1,618	6,889	6,398	7,242	11,610
12. Cat Tien district	874	2,152	2,015	1,905	3,576

Source: Statistical Department of Lam Dong

Vegetables such as tomato, cabbage and lettuce are grown very popularly in Lam Dong and with large amounts (Table 4). Tomato production areas in Duc Trong and Don Duong districts reach average of 300 ha, Don Duong has the largest area under vegetable cultivation of this province. A part from that, leafy vegetables such as cabbage, lettuce are grown in Da Lat City.

Table 12: Area, yield and production of tomato, cabbage, lettuce in Lam Dong in 2010

No	Crops	Area (ha)	Yield (tons/ha)	Production (ton)
	Whole province	43,598	28.8	1,296,424
1	Tomato	5,000	70	350,000

2	Cabbage	6,400	80	512,000
3	Lettuce	1,800	50	90,000

Source: Statistical Department of Lam Dong

Lam Dong is one of the major vegetable production areas in Vietnam. With its temperate and cool climate, vegetables are grown year round in Lam Dong, especially temperate and subtropical vegetables. Area, yield and production of vegetables have been increased in recent years. Because, concentrated intensive production areas, farmers have, therefore, highly intensive cultivation techniques. Due to high land use coefficient, one field can have vegetables for year-round to facilitate a good food source for food source for insects and pests, making a powerful movement of butterfly from harvested field to new planting fields, so it is hard to avoid the regular use of chemicals. Averagely, farmers have to spray 12-15 times with the dose of 4-5 kg chemicals/during a cabbage cycle grown in Da Lat of 75-90 day (Pham Xuan Tung, 2005). In addition, many farmers use highly poisonous pesticides to treat seeds, using pesticides of unknown origin, continuous use of the same chemical ... In addition to pesticide residues, residual nitrate (NO₃) content higher the MRL in fresh vegetable products are two main factors making vegetables unsafe, harmful to the health of users. The unbalanced fertilization, over dosage, abuse of chemical fertilizers is a major cause of increased levels of nitrates, heavy metals in vegetable products, affecting vegetable quality, human health and environmental pollution.

PART 3. MATERIALS, ACTIVITIES, LOCATION AND METHODOLOGY

3.1. MATERIALS

3.1.1. Variety

- Hung Yen: Gherkin: Anoso
Cherry tomato: Thuy Hong
- Son La: Tomato: Savior and VL 2910
Chayote: Local variety
- Lam Dong: Tomato: Anna
Cabbage: Nova.

3.1.2. Fertilizers and pesticides

- At demonstrations in Hung Yen

Fertilizers:

No	Tomato	No	Gherkin
1	Decomposed manure	1	Decomposed manure
2	Powdered lime	2	Powdered lime
3	Urea	3	Urea
4	Superphosphate	4	Superphosphate
5	Potassium chloride	5	Potassium chloride
6	NPK Dau Trau: 16:16:8	6	NPK Dau Trau: 16:16:8
7	Foliage bioproducts: Dong Bien, Antonic.....		

Pesticides:

No	Tomato	No	Gherkin
1	Abamectin	1	Abamectin
2	Afamil	2	Afamil
3	Actara	3	Actara
4	Regent	4	Regent
5	Ridomil	5	Ridomil
6	Copper Oxychloride	6	Mancozeb
7	Mancozeb		

- At demonstrations in Son La

Fertilizers

No	Tomato	No	Chayote
1	Decomposed manure	1	Decomposed manure
2	Powdered lime	2	Powdered lime
3	Urea	3	Urea
4	Superphosphate	4	Superphosphate
5	Potassium chloride	5	Potassium chloride
6	NPK Dau Trau: 16:16:8	6	NPK Dau Trau: 16:16:8
7	Foliage bioproducts: Rong Bien, Antonic.....		

Pesticides:

No	Tomato	No	Chayote
1	Ridomil Gold 68WG	1	Copper Oxychloride 60 WP
2	Copper Oxychloride 60 WP	2	Score 250 EC
3	Score 250 EC	3	Antracol 70WP
4	Antracol 70WP	4	Pegasus 5 EC
5	Vitaco 2g	5	
	Sherpa 25 EC		

- At demonstrations in Lam Dong

Fertilizers

No	Tomato	No	Cabbage
1	Decomposed manure	1	Decomposed manure
2	Powdered lime	2	Powdered lime
3	Urea	3	Urea
4	Superphosphate	4	Superphosphate
5	Potassium chloride	5	Potassium chloride
6	NPK: 16:16:8	6	N:P:K (15:5:20)
7	N:P:K 20:20:15	7	N:P:K (20:20:10)
8	Bioproducts: Humic, Monseren, Antonic	8	Bioproducts: Humic, Monseren, Antonic

Pesticides

No	Tomato	No	Cabbage
1	Ridomil Gold 68WG	1	Kasuran 47WP
2	Curzate ^R M-8 72WP	2	Takumi 20WG
3	Atinovate	3	Ammate 150SC
4	Score 250 EC	4	Pegasus 500
5	Antracol 70WP	5	Sumileo
6	Miktin,		
7	Antivo		
8	Mikmire		

3.2. ACTIVITIES

- Observation of plant growth and development
- Observation of main pests and diseases
- Yield and yield components
- Analysis of quality as NO₃ content heavy metal content, pesticide residue and pathogenic microorganisms in products.
- Economic efficiency of tomato and cabbage production demonstrations in compliance with VietGAP.

3.3. METHODOLOGY OF ESTABLISHING DEMONSTRATIONS

3.3.1. Location and scale

- Hiep Cuong – Kim Cuong – Hung Yen: 1 ha of cherry tomato and 1 ha of gherkin x 2 seasons
- Thanh Nghia cooperatives – Don Duong – Lam Dong: 1 ha of tomato and 1 ha of cabbage x 2 seasons
- 19/5 Agriculture and Service Cooperatives – Nong Truong town – Son La: 8,000m² of safe chayote and 4,000 m² of tomato.
- Tu Nhien village – Dong Sang commune Moc Chau district - Son La province: 2000 m²

3.3.2. Duration

- + Winter - spring: 10/2011 –2/2012
- + Spring -summer: 3/2012 – 7/2012

2.3.3. Implementing methods

- PTD - Participatory technology development

- Field conferences/field days to visit and visually evaluate demonstrations, thereby recommending multiplication of demonstrations rather than traditional customs.

- Dissemination of new technologies via newspapers and televisions.

3.3.4. Cultural practices

Application of VCU the testing protocol and safe tomato, cabbage production protocols in compliance with VietGAP; the production protocols of gherkin, cherry tomato, chayote production in compliance with VietGAP safety as compiled by the project.

*** Tomato:**

Unit: amount of fertilizers per 1 ha

Fertilizers	Total	Basal	Dressing			
			1 st	2 nd	3 rd	4 th
Decomposed fertilizer (Ton)	30	30	-	-		
Powdered lime (kg)	1,000	1,000				
Borat (kg)	100	100				
N: P:K 16:16:8 (kg)	1,500	250		500	500	250
Lam Thao Superphosphate (kg)	1,000	1,000				
Phu My Urea (kg)	450	200	250			
Potassium chloride	250		250			

Methods of fertilizer application:

- Basal application: all decomposed manure, powdered lime, Lam Thao Superphosphate, surface broadcasting, mixing and nylon mulching at 7 days before transplanting.
- Dressing application
 - + 1st : at 15 days after transplanting
 - + 2nd : at 30 days after transplanting
 - + 3rd : at 65-70 days after transplanting
 - + 4th : at 90 days after transplanting

Additional watering of foliage fertilizers at 30-45 days after transplanting with 100g Humic/ha/time, 500 g Monseren/ha/time (spraying twice at 7 days interval)

*** Cabbage**

Unit: amount of fertilizers per 1 ha

Fertilizers	Total	Stage of application				
		Basal	1 st dressing	2 nd dressing	3 rd dressing	4 th dressing
Organic fertilizer (ton)	30	30				
Lime(Kg)	1,500	1500				
Urea (Kg)	300	30	100	100	10	
Superphosphate (kg)	1,500	1500				
Potassium chloride (kg)	350		100	100	150	
NPK 20:20:10	1,100		300	400	400	
NPK 15:5:20	150					150
		Before transplanting	10 -15 days after transplanting	25-30 days after transplanting	40-45 days after transplanting	50 days after transplanting

During cultivation, additional use of foliage fertilizer:

- Atonic: basestem irrigation, foliage spraying, dose of 600ml/ha/spraying time
- After each dressing, spraying foliage fertilizer (Rong Bien) three times at 7 days intervals with dose of 600 ml/ha/praying time

*** *Chayote***

- The amount of decomposed manure for 1 ha is 15-20 tons of fertilizer used for basal application, in case of unavailability of decomposed manure, biological organic fertilizers can be used at 1.5 to 2 tons/ha.
- Total amount of fertilizer for 360 m² (Northern Sao): 20 kg of powdered lime, 500-700 kg of decomposed manure, 50 kg of superphosphate, 10kg of potassium chloride, 30 kg of urea.

Dosage and applying methods are as follows:

Fertilizer	Fertilizer amount		Basal (%)	Dressing (%)				
	(kg /ha)	(kg/360 m ²)		1 st	2 nd	3 rd	4 th	5 th
Decomposed manure /Microbial fertilizer	15,000-20,000 1,500-2,000	540- 720 55 - 72	100					

Urea	400	30	0	20	30	20	20	10
Superphosphate	250	9	10	20	20	20	20	10
Potassium chloride	130	4.6	0	10	20	30	20	20
Podwered lime	560	20	100					

- Basal application of all manure, lime and 10% of superphosphate at 7 days before transplanting.
- Dressing application at 5 times:
 - 1st: at 15 – 20 days after transplanting
 - 2nd: at first flowering stage
 - 3rd: at fruit setting stage, or first shoot harvesting time
 - 4th: at fruit harvesting time
 - 5th: after 2 -3 continuous fruit harvesting times.

*** *Cucumber***

Fertilizer amount:

Fertilizer	Amount (kg/ha)	Amount (kg/ sao)	Basal (%)	Dressing (%)		
				1 st	2 nd	3 rd
Decomposed manure	15.000-20.000	750-1000	100	-	-	-
N	120	5	0	20	40	40
P ₂ O ₅	90	4	50	25	25	-
K ₂ O	120	5	30	10	30	30

In case of unavailability of decomposed manure, microbial fertilizer can be replaced at dose of 3,000-3,500 kg/ha.

Methods of fertilizer application:

- + 1st: at rooting plant stage
- + 2nd: at first female flowering stage
- + 3rd: at first fruit harvesting stage

3.3.5. Observed criteria

*** *Tomato***

- Some characteristics of the growth of tomato plants: final plant height, branching ability, duration of growth stages
- The prevalence of some pests and diseases of tomato plants: downy mildew disease, viral disease, leaf blight, fruit borers and white fly.
- Yield and yield components: number of fruits/plant; average fruit weight; individual yield, actually obtained yield.
- NO₃ content, heavy metal content, pesticide residues (mg / kg), pre-harvest

microorganisms.

- Analysis of economic efficiency

*** *Cabbage***

- Some characteristics of the growth of cabbage plants: plant height, canopy width, number of inner and outer leaves, duration of growth stages

- The prevalence of some pests and diseases of cabbage plants: soft rot, leaf spot, root club, diamond back moth, green worm .

- Yield and yield components: average head weight; marketable yield, actually obtained yield.

- NO₃ content, heavy metal content, pesticide residues (mg / kg), pre-harvest microorganisms.

- Analysis of economic efficiency

*** *Chayote***

- Some characteristics of the growth of chayote plants: plant height, canopy width, duration of growth stages

- The prevalence of some pests and diseases of chayote plants: downy mildew, leaf spot, green worm.

- Yield and yield components: number of fruits/plant; average fruit weight; marketable yield, actually obtained yield.

- NO₃ content, heavy metal content, pesticide residues (mg / kg), pre-harvest microorganisms.

- Analysis of economic efficiency

*** *Cucumber***

- Some characteristics of the growth of chayote plants: plant height, canopy width, duration of growth stages

- The prevalence of some pests and diseases of chayote plants: downy mildew, leaf spot, green worm

- Yield and yield components: number of fruits/plant; average fruit weight; marketable yield, actually obtained yield.

- NO₃ content, heavy metal content, pesticide residues (mg / kg), pre-harvest microorganisms.

- Analysis of economic efficiency

PART 4. RESULTS OF IMPLEMENTATION

4.1. Results of demonstrations in Hung Yen

4.1.1. Infrastructure investment

- The project has funded organizing production and building a tank of organic fertilizar storage, and tank of pesticides containers and a HAVECO field WC.

4.1.2. Results of demonstrations

- Four facilitators of demonstrations include 02 of Fruit and Vegetable Research Institute (01 technical staff - Nguyen Xuan Diep, 01 VietGAP supervisor - Nguyen Thi Huong), 01 of DARD Hung Yen, 01 staff of HAVECO
- Vegetable crops in the demonstrations: gherkin and cherry tomato;
- Variety, seasons, area of demonstration: 04 ha (02 planting seasons; 01 ha of gherkin/planting, 01 ha of cherry tomato)



Table 13. Demonstrations of cherry tomato and gherkin cultivation in winter – spring and spring – summer 2011-2012

Crop	Variety	Area	Planting time	First harvesting time	Last harvesting time	Yield (ton/ha)
Planting season 1						

Gherkin	Anoso	1 ha	2/10/2011	10/11/2011	15/12/2011	27.6
Cherry tomato	Thuy Hong	1 ha	26/10/2011	7/12/2011	15/02/2012	58.7
Planting season 2						
Cherry tomato	Thuy Hong	1 ha	15/1/2011	25/03/202	4/6/2012	50.2
Gherkin	Anoso	1 ha	25/02/2012	7/4/2012	23/5/2012	31.8

- Main pests and diseases in the year: different types of plants are affected by different types of pests and diseases

+ Tomato plants: downy mildew, leaf spot, leaf miner, fruit borer ...

+ Cucumber plants: Diamond Back Moth, green worm, army worm, soft rot, collar rot, downy mildew, powdery mildew, late blight

- Commonly used fertilizer, pesticide types by farmers:

+ Pesticides: Use chemicals with active ingredients such as Emamectin Benzoate, Abamectin ...

+ Germicides: Use chemical with active ingredients such as Metalaxyl, Mancozeb, Validamycin, Cabendazim, chlorothalonil ... for prevention and treatment

- Pesticide and fertilizer use methods:

Vegetable production in the project site use fertilizers, pesticides according to the "*four right principles.*" Pesticides in the market are of various kinds, if it is not used correctly, ineffectiveness, wastage and environmental pollution could occur. In the production protocols, before fertilizing or spraying pesticides, workers are directly instructed by facilitators in terms of "Using the *right pesticides, right dose, right time and right method.*"

Crops in the demonstrations had good growth and development. Compared with the MRL (Maximum Residue Limits) of pesticides, heavy metals, nitrates and microorganisms, all harvested products have met food hygiene and safety and quality standard.

Table 14: Quality of cherry tomato and cucumber in winter – spring and spring – summer 2011-2012 in Kim Dong, Hung Yen

No	Criteria	Planting season 1		Planting season 2		MRLs
		Cherry tomato	Gherkin	Cherry tomato	Gherkin	
1	Abamectin	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	(0,02)
2	Benomyl	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	(0.02)
3	Chlorpyrifos	<i>Not detected</i>	<i>Not detected</i>	<0.0002	<i>Not detected</i>	(0.1)
4	Cypermethrine	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	(0.05)
5	Metalaxyl	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	(0.5)
6	Deltamethrin	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	(0.5)
7	Arsen(As) mg/kg	0.0184	0.152	0.0195	0.152	1.0*
8	Cadimi(Cd) mg/kg	0.0547	0.014	0.0248	0.014	0.1*
9	Copper (Cu)mg/kg	1.0958	0.70	1.548	0.70	30*
10	Mercury (Hg)mg/kg	0.0014	0.006	0.0013	0.006	0.05*
11	Leaf (Pb)mg/kg	0.1278	0.061	0.02801	0.061	0.1*
12	Nitrate(NO ₃ ⁻) mg/kg	142	135	146	135	150*
13	Salmonella TB/g	0	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	0*
14	E.coli - TB/g	4	<i>Not detected</i>	5	<i>Not detected</i>	10*
15	Coliform - TB/g	50	90	85	90	200*

Source Division of Fruit and Vegetable Quality Control - FAVRI

- Process of growth, development, harvesting, post harvest handling:

Crops in the demonstrations had growth and development and marketed at high price. Households involved in the demonstrations strictly followed well harvesting methods as guided by technical staff, reducing post harvest losses.



- Field sanitation, waste control was well implemented: under the project support, manures, plant debris was stored with microbial yeast, pesticides containers were collected in a tank for disposal,... meeting VietGAP principles.



Before project

After project

Vegetable products of the demonstrations were purchased at high price by HAVECO and then exported to other countries Taiwan, France, Russia,... with high economic efficiency

Table 15: Economic efficiency of 1 ha demonstration

Unit: 1,000 VND

Crops	Income(VND)	Input (VND)	Net return (VND)
<i>Planting season 1</i>			
+ Cherry tomato	352,200	167,300	184,900
+ Gherkin	220,800	102,500	118,300
<i>Planting season 2</i>			
+ Cherry tomato	301,200	167,300	133,900

+ Gherkin	254,400	102,500	151,900
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a. Awareness of workers and farmers in vegetable production in compliance with VietGAP:

Before the project, workers and farmers awareness of safe vegetable production in compliance with VietGAP was limited: no periodic pesticide spraying, overdosed spraying, highly poisonous pesticide use, unbalanced and much use of inorganic fertilizers especially urea, no habit of daily recording. However, after the project implementation, with the support of the Department of Agriculture and Rural Development of Hung Yen as well as Fruit and Vegetables Research Institute, HAVECO's workers and farmers awareness has been improved, thereby understanding benefits of vegetable production in compliance with VietGAP and fully recording.

With direct support of technical staff, operation of the demonstration has been carried out properly with more effective pests and diseases control, reduced spraying times, proper PHIs.

b. Internal audit activities:

- Content: groups monitored each other, additionally guided technical support each other in the process of implementation;

- Method: facilitators were directly involved in production with the groups and monitored and evaluated each other, expressing advantages and disadvantages of what they have done to draw experiences for coming time.

Advantages and disadvantages

- Advantages:

- The project has been paid much attention to by the project coordination unit, leaders of DARD Hung Yen, Hiep Cuong Commune People Committee, Hiep Cuong Agriculture and Service Cooperatives, women union, farmer association at commune level, ... In addition, safe vegetable production is one of the fields that People Committees at Provincial and other levels has paid a lot of attention to; in the near future, there will be a plan of investment in mechanisms and policies for development of production infrastructure, capacity building to develop safe vegetable production in the locality;
- There are a cadre of technical staff, management staff from provincial to district and commune levels who are qualified to organize and lead

the production and capable for acquirement of technical advances to transfer to farmers for implementation;

- The project site is located in a position of convenient transportation for project deployment and implementation;
- Workers and farmers involved in the project has high intensive cultivation expertise, quickly acquiring and applying technical advances to production. In addition, many concentrated agricultural production areas have been established.



- The activities and method of learning by doing (combined theoretical and practical lessons) has attracted farmers involved in the production of their fields to achieve good results.

- Disadvantages:

+ It is slow to totally change arbitrary habits of cultivation, chemical fertilizers, pesticides use of farmers;

+ It is not easy to organize production in which farmers will follow the same protocol. Safe vegetable production in compliance with VietGAP is voluntary, thus, it is impossible to use administrative measures to compel, but only through propaganda and mobilization;

+ Production cost is high, without trademark so market of VietGAP vegetables is limited.

+ Recording is complicated for farmers.

4.1.3. Field conference to introduce demonstrations of safe cherry tomato and gherkin production in compliance with VietGAP

Date: 12/7/2012

Location: Hiep Cuong PC, Kim Dong district, Hung Yen

Participants: 50, including:

- DARD Hung Yen: Crop Production Division, Quality Control Sub Department of agricultural, Forestry and fishery products, PPSD, Extension Center.
- Kim Dong district: District Agricultural Division.
- Hiep Cuong commune: Leaders and officials of commune and cooperatives
- HAVECO Company: leaders and staff
- Fruit and Vegetable Research Institute
- Television of Hung Yen province.

The Conference listened to the project results implemented in Hung Yen province in term of training and demonstration establishment. The speeches by local leaders and farmers were good reviews and they looked forward to expanding the project activities in terms of size and plant species. The conference also proposed market and the linkage between partners in the project to be more promoted

4.2. Results of demonstrations in Son La

4.2.1. Infrastructure investment

The project supported 100% budget for the organization of production and 70% of budget for building a handling and packaging house in the 19/5 Agriculture and Service Cooperatives.

4.2.2. Results of demonstrations

- Facilitators of demonstrations include 4 staff: 02 from Fruit and Vegetable Research Institute (01 technical staff – Trương Văn Nghiệp; 01 VietGAP supervisor -Nguyen Thi Kim Son); 01 DARD Son La staff; 01 staff of 19/5 Agriculture and Service Cooperatives.
- The technical measures applied: it is safe tomato and chayote production protocols compiled by Fruit and Vegetable Research Institute

4.2.2.1. Tomato demonstration in Autumn – Winter 2011

- Sowing date: 2/8/2011
- Transplanting date: 28/8/2011
- Variety used: VL 2910
- Area: 2,300 m².

- Implementing location: Tu Nhien village – Dong Sang commune – Moc Chau district – Son La

Table 16: Growth and development of tomato plants in the demonstration.

Time	Growth stages	DAT (days)	Pest and disease occurred	Pesticides used
2/8– 28/8/2011	Sowing– Transplanting	26 -28	Collar rot, leaf miner	- Ridomil MZ 72WP, Vitaco 2 g
29/8 – 3/10/2011	Transplanting – flowering	30- 35	Downy mildew, leaf miner	- Ridomil MZ 72WP, Vitaco 2 g
3/11/2011	Flowering – first fruit harvesting time	30	Fruit borer, downy mildew	Vitaco 2 g, Thianmectin, Ridomil MZ 72WP,
After 7 -10 days	1st - 2nd fruit harvesting time	7-10	Few pests and diseases occurred	No spraying
	2nd – 3rd fruit harvesting time	7		No spraying
	3rd – 4th fruit harvesting time	7		No spraying
	4th – 5th fruit harvesting time	15	Downy mildew	Ridomil MZ 72WP

Table 17: Yield and mean prices, total income of the demonstration

Comparison	No of fruits/plant (fruit)	Mean fruit weight (gram)	Theoretical yield (ton/ha)	Actual yield (ton/ha)	Mean price (VND1,000)	Total income (VND1,000)
Demonstration	40 -45	90	94.50	75.60	7,500	567,000
Control	37-40	85	80.75	64.60	7,000	452,200

Investment cost was about VND270 million /ha and net return reached 50% of investment value.



4.2.2.2. Tomato demonstration in spring – summer 2012

Table 18: Variety and duration via stages of growth and development of off season tomato plants

No	Variety	Source of variety	Transplanting date	First flowering time	First harvesting time	50% fruit harvesting time
1	VL2910	<i>Seminis</i>	15/3/2012	1/5/2012	3/6/2012	5/7/2012
2	Saviro	<i>syngenta</i>	5/3/2012	30/4/2012	27/5/2012	25/6/2012

Table 18 showed that duration from transplanting to first harvesting time is 85- 90 days, saviro variety have 5-7 day earlier fruit harvesting time than VL2910 one.

Table 19: Fruit shape, yield of off season tomato in Moc Chau

No	Variety	Fruit shape	Mean fruit weight (gram)	Individual yield (Kg)	Yield per ha (ton/ha)
1	VL2910	Long and round	85 -90	3.5	87.50
2	Saviro	Long and round	90 -100	3.9	97.50

The varieties involved in the demonstrations have round and long shape which is preferred by superior vegetable market, average volume weight is from 85 -100 grams and Saviro gives the higher mean fruit weight and yield than VL2910. VL2910 variety is preferred by farmers in Moc Chau area as it has been introduced in this area for 2-5 years and when planted in the demonstrations and compared with the Saviro variety, the yield and quality of Saviro was better than those of VL 2910. This is the basis to promote propagation of the demonstration in the coming years

*** Tomato.**

- When applying new technical advances in production, yield increased by 20-30% at 70-80 tons/ha, ensuring food hygiene and safety, fruits with nice appearance (1st grade) reached 90-95 %.
- The project supported 100% budget for the organization of production and 70% of construction cost of a handling and packaging house a in the 19/5 Agriculture and Service Cooperatives.

Table 20: Main pest and disease prevalence

No	Variety	Downy mildew	Bacterial wilt (%)	TYLCV (%)	Fruit borer (%)
1	VL2910	Medium	2 -3	2-4	1-2
2	Saviro	Medium	2-3	Not infected	1-2

- Table 20 showed that disease prevalence is at very slight extent, biological and low – toxic and short PHI chemical pesticides were selected to spray.
- Results of pesticide residue analysis of the demonstration products using rapid assay method indicated that there were no detectable pesticide residues in analyzed product, meeting food hygiene and safety.

4.2.2.3. Chayote demonstration in spring – summer 2012

- Area: 0.4 ha.
- Location: 19/5 Agriculture and Service Cooperatives

Table 21: Duration of growth and development stages of off season tomato plants

No	Variety	Transplanting date	First flowering time	First harvesting time
1	Chayote	15/3/2012	20/5/2012	30/5/2012

- The results showed that chayote plants had 75-60 days from transplanting to First harvesting time.

Table 22: Yield, main pest and disease prevalence of chayote plants

No	Variety	Yield (ton/ha)	Downy mildew	Spider
1	Chayote	70 -80	Medium	Few

- Farmers involved in the demonstration have applied well technical measures in compliance with VietGAP standards. The demonstration achieved good results and gave high economic benefits to growers.
- Appearance of fruit: 95% of chayote fruit with nice appearance met export requirements, mean price (high) of 8,000 -10,000 VND/kg, while the average market price of 3,000 to 5,000 VND/kg , which was 2 times higher than conventional production, 10-20% higher yield than traditional production at 70-80 tons of fruits/ha.
- For chayote plants using concrete pillars as trellising to replace wooden pillars, it is reducing wooden exploitation trellising.
- Demonstration results are propagated to producers in Sang Dong and Van Ho commune. There have been two propagated demonstrations in the 2 communes giving 20-30% higher income than traditional production, thereby making farmers to be positively involved.
- Results of pesticide residue analysis of the demonstration product using rapid assay method showed that there were no detectable pesticide residues, ensuring food hygiene and safety.
- Farmers in Tu Nhien village – Dong Sang commune have been certified as the safe vegetable production area by Son Lan Quality Control Sub Department of Agricultural, Forestry and Fishery products.



4.2.3. Field conference to introduce demonstrations of safe off season tomato and chayote production in compliance with VietGAP

Date: 3/7/2012

Location: demonstrations of 19/5 Agriculture and Service Cooperatives and Dong Sang CPC, Moc Chau district, Son La

Participants: 71, including:

- DARD Son La: Crop Production Division, Quality Control Sub Department of agricultural, Forestry and fishery products, PPSD, Extension Center.
- Moc Chau district: Deputy Chairman of DPC, District Agricultural Division, Plant Protection Station, District Extension Station
- Dong Sang commune: Leaders and officials of commune and cooperatives
- 19/5 Agriculture and Service Cooperatives: leaders and staff
- Fruit and Vegetable Research Institute
- Television of Son La province.

The Conference visited demonstrations and listened to the project results implemented in Son La province in term of training and demonstration establishment. The speeches by local leaders and farmers were good reviews and they looked forward to expanding the project activities in terms of size and plant species. The conference also proposed to organize more training courses for farmers, and to promote linkage between partners in the project.

4.3. Results of demonstrations in Lam Dong

4.3.1. Infrastructure investment

The project has funded organizing production and building a tank of organic fertilizar storage, and tank of pesticides containers and a Cooperative field WC.

4.3.2. Results of demonstrations

- Four facilitators of demonstrations include 02 of Fruit and Vegetable Research Institute (01 technical staff – Duong Kim Thoa, 01 VietGAP supervisor - Nguyen Thi Huong), 01 of DARD Lam Dongg, 01 staff of Thanh Nghia Cooperatives

4.3.2.1. Tomato

- Growth and development characteristics of Anna tomato in the demonstration
 - Characteristics of tomato growth and development depends on the genetic nature of varieties, in addition, it also depends very much on external factors such as temperature, humidity, light ... Based on growth of the variety, we can assess the level of variety adaptability to environmental conditions, as well as have a reasonable technical intervention to bring the highest economic efficiency. A variety considered promising to grow is the one that have good growth and development, potential for high yield, good quality, wide adaptation, and can be grown in many seasons/year and in different ecological conditions.
 - Research results of the growth characteristics of Anna tomato variety showed that it had stable growth, but growing in greenhouse conditions make it have longer growth duration due to the weaker light intensity (10 days longer than open field cultivation. Similarly, with the growing conditions in a greenhouse it had higher height (about 10-15 cm) than planting in open field.

Table 23: Growth characteristics of Anna tomato variety in the demonstration in winter – spring 2011-2012

No	Household name	Duration from transplanting to(days)			Plant height (cm)
		50% of flowered plants	First harvesting time	Last harvesting time	
1	Nguyen Van Lanh	28	72	145	145.6
2	Tran Van Mang	25	68	135	130.5
3	Tran Tan Xi	28	73	145	145.3
4	Nguyen Dinh Quy	26	67	135	132.8
5	Huynh Thi Gai	25	68	135	130.7
	Mean value	26.4	69.6	139	136.98

- Between planting season 1 and 2, duration of growth stages of tomato in winter – spring was longer than the summer, due to higher temperatures, more rainfall in summer that shortened the duration of growth stages of tomato. Similarly, due to the growth and development in favorable

conditions, tomato plant height in winter – spring was higher than in summer (Tables 23 and 24).

Table 24: Growth characteristics of Anna tomato variety in the demonstration in summer 2012

No	Household name	Duration from transplanting to(days)			Plant height (cm)
		50% of flowered plants	First harvesting time	Last harvesting time	
1	Nguyen Van Lanh	22	62	107	134.6
2	Tran Van Mang	23	62	100	135.2
3	Tran Tan Xi	23	63	103	137.2
4	Nguyen Dinh Quy	23	63	100	130.6
5	Huynh Thi Gai	23	64	106	136.4
	Mean value	22.8	62.8	103.2	135.85

- Main pest and disease prevalence
 - Tomatoes are a host of a wide variety of diseases, of which downy mildew disease (*Phytophthora infestans*), leaf spot disease (*Cladosporium farlvum*), bacterial wilt (*Ralstonia solanacearum*) and tomato yellow leaf curl virus disease (TYLCV) are the major diseases that producers and breeders pay special attention to. Especially, with tomato production conditions of Lam Dong, where vegetables in general and tomatoes in particular can be grown year round, pressure of pests and diseases is very high.
 - Monitoring results on the field and diseases showed that there was no occurrence of bacterial wilt disease in the tomato demonstration.
 - Downy mildew is the thriving disease that has caused serious damage on tomatoes in Lam Dong in recent years in general and Thanh Nghia – Thanh My – Don Duong – Lam Dong. Therefore, the issue of pesticide use to control this disease is becoming more serious, such as more chemical use, more average spraying times per season which is the main cause of influencing pesticide residues in products. Households participating in the demonstrations were trained on vegetable production techniques in compliance with VietGAP under supervision and technical support of technical staff in pesticide use that has contributed to improving their proper

awareness and take the reasonable measures to use pesticides, avoiding wasting chemicals and labor that have better pest and disease control.

- Results of demonstration implementation indicated that tomato crop in the demonstrations were affected by diseases at slight level (1 in scale of 5) due to timely pesticide spraying downy mildew and leaf spot diseases.
- Virus is an important pathogenic factor influencing tomato yield, quality, particularly for the past 10 years. White fly is a dangerous transmitted factor, in addition to virus transmission, it is also an insect of the sucking group, that suck plant silent sap, making leaves and stem dry in severe cases, limiting the transport of nutrients for plant growth, as well losing plant photosynthesis in the case of high-density of white flies on the leaf surface. The observed results showed that population of white flies was much reduced in greenhouse compared with the open field tomato, and the virus diseases were proportional to the population of white flies. In the pilot demonstrations, density of white flies tended to increase at the end of the tomato harvest, so the extent of damage caused by them is not high, tomatoes in the demonstration gave very high yield.
- The winter-spring with dry weather conditions was favorable for development of white flies that is the reason to make tomato plants infected by virus and higher density of white flies than in summer.
- Fruit borer is the most important pest influencing tomato yield and quality. Because of application of proper planting and maintenance, the percentage of pests in the demonstrations was only about 0.3 to 1.2% in winter – spring, which it was higher in summer due to high humidity, weak light intensity, heavy rain, making tomato plants damaged by fruit borers as well as high rate of cracked fruits in summer at 0.88% while no cracked fruits in winter – spring, increasing tomato marketable yield. (Table 25; 26).

Table 25: Main pest and disease prevalence of Anna tomato variety in winter – spring 2012

No	Household name	Downy mildew (scale of 1-5)	Leaf spot (scale of 1-5)	Virus disease (%)	Fruit cracking rate (%)	White fly	Fruit borer (%)
1	Nguyen Van Lanh	1	1	1.5	0	+	0.5
2	Tran Van Mang	1	1	3.5	0	+++	1.2
3	Tran Tan Xi	1	1	1.5	0	+	0.3

4	Nguyen Dinh Quy	1	1	2.5	0	++	0.5
5	Huynh Thi Gai	1	1	3.0	0	++	0.5
	Mean value	1	1	2.4	0	++	0.6

**Table 26: Main pest and disease prevalence of Anna tomato variety
In summer 2012**

No	Household name	Downy mildew (scale of 1-5)	Leaf spot (scale of 1-5)	Virus disease (%)	Fruit cracking rate (%)	White fly	Fruit borer (%)
1	Nguyen Van Lanh	1	1	1.5	0	+	0.7
2	Tran Van Mang	1	1	1.7	1.5	+	1.3
3	Tran Tan Xi	1	1	1.7	0	+	1.3
4	Nguyen Dinh Quy	1	1	1.8	1.7	+	1.5
5	Huynh Thi Gai	1	1	1.5	1.2	+	0.8
	Mean value	1	1	1.64	0.88		1.12

- Yield and yield components
 - Yield and yield components are the first factors paid attention to by both breeders and producers. Results showed that Anna tomato gave good growth and development in Thanh My- Dong Duong – Lam Dong. However, depending on technical, caring and planting conditions, yield varied. In the demonstration, 02 households planted tomato in the greenhouse where tomato plants were better protected from pests and diseases, had better and brighter fruit appearance, but longer and smaller internode, longer fruit petiole (due to the lowest light intensity in winter – spring) to make fruit petioles break, weak ability to transport nutrients to feed fruits , thereby giving lower yield than the one in open field in the same cultivation conditions. Specifically, the highest yield of 125 tons/ha was given by tomato field of Mr. Tran Van Mang, while greenhouse tomato gave yield 105 tons/ha in the field of Mr. Nguyen Van Lanh and Mr. Tran Van Xi. Other households obtained lower yield at only 95.57 tons/ha and 90.75tons/ha by Mr. Nguyen Dinh Quy and Huynh Thi Gai, respectively in winter - spring 2011 - 2012. The highest marketable yield in the demonstration was 96.3%.

- In the summer season, due to unfavorable weather, heavy rain, high humidity reduces the tomato harvesting duration, pest and disease development, the increased rate of fruit cracking, especially the ability to harvest last fruit clusters was low, influencing tomato yield and marketable yield particularly. With an average yield of approximately 64.26 tons/ha and marketable yield of 90.51%, lower than those in winter - spring season (Table 27, 28).

Table 27. Yield and yield components of demonstration households in winter – spring 2011-2012

No	Household name	No of fruits/plant	Individual yield (kg/plant)	Marketable yield (ton/ha)	Actual yield (ton/ha)	Rate of marketable products (%)
1	Nguyen Van Lanh	52.7	4.5	105.63	110.75	95.38
2	Tran Van Mang	63.5	5.05	125.27	128.68	97.35
3	Tran Tan Xi	57.8	4.67	104.83	110.92	94.51
4	Nguyen Dinh Quy	53.5	4.3	95.56	98.46	97.05
5	Huynh Thi Gai	53.8	4.2	90.75	93.35	97.21
	Mean value	56.26	4.544	104.408	108.432	96.30
	Control	50.87	4.25	92.76	96.87	95.76

Table 28: Yield and yield components of demonstration households in summer 2012

No	Household name	No of fruits/plant	Individual yield (kg/plant)	Marketable yield (ton/ha)	Actual yield (ton/ha)	Rate of marketable products (%)
1	Nguyen Van Lanh	40.5	3.0	65.73	75.0	87.64
2	Tran Van Mang	37.5	2.7	60.35	67.5	89.41
3	Tran Tan Xi	35.8	2.6	60.27	65.0	92.72
4	Nguyen Dinh Quy	38.5	2.7	62.52	67.5	92.62
5	Huynh Thi Gai	43.8	3.2	72.45	80.0	90.56
	Mean value	39.22	2.84	64.26	71.0	90.51
	Control	38.6	2.62	62.75	69.85	89.83

- Obtained results showed that farmers of Thanh Nghia Cooperatives had relatively high and uniform level of cultivating tomatoes, thereby making

tomato yield and yield components of demonstration farmers in 2 planting season quite the same. Therefore, the differences that should be paid attention to here is the quality and economic efficiency of these two types of production.

- Results of quality analysis of demonstration tomato products
 - Product quality and safety is important and necessary criteria in the current vegetable production. Results of quality analysis of tomato products in both planting seasons indicated that products obtained from the demonstration was not detected with pesticide residues and pathogenic microorganisms. Residues of heavy metals was detected but below MRL, the products met food hygiene and safety standard.

Table 29. Results of quality analysis of demonstration tomato products

No	Criteria	Analyzed results		MRLs
		Winter – spring	Summer	
1	Abamectin	Not detected	Not detected	(0.02)
2	Benomyl	Not detected	Not detected	(0.02)
3	Chlorpyrifos	Not detected	Not detected	(0.1)
4	Cypermethrine	Not detected	Not detected	(0.05)
5	Metalaxyl	Not detected	Not detected	(0.5)
6	Deltamethrin	Not detected	Not detected	(0.5)
7	Arsen (As) mg/kg	0.052	0.064	1.0*
8	Cadimi (Cd) mg/kg	0.014	0.019	0.1*
9	Copper (Cu) mg/kg	0.70	1.06	30*
10	Mercury (Hg) mg/kg	0.006	0.008	0.05*
11	Lead (Pb) mg/kg	0.061	0.059	0.1*
12	Nitrate (NO ₃ ⁻) mg/kg	135	128	150*
13	Salmonella TB/g	Not detected	Not detected	0*
14	E.coli TB/g	Not detected	Not detected	10*
15	Coliform TB/g	20	15	200*

- **Economic efficiency of tomato production demonstration in compliance with VietGAP**

Table 30. Economic efficiency of tomato production demonstration in Thanh Nghie Cooperatives

Unit : 1,000 VND

No	Items	Summer		Winter - spring	
		In compliance with VietGAP	Traditional production	In compliance with VietGAP	Traditional production
I	Expenditure (VND)	18,993,000	19,791,000	15,992,000	16,232,000
1	Seedlings	1,750,000	1,750,000	1,750,000	1,750,000
2	Fertilizers	4,553,000	4,553,000	3,747,000	3,747,000
3	Pesticides	3,625,000	4,123,000	1,510,000	1,750,000
4	Other materials (staking, mulching, wiring)	1,565,000	1,565,000	1,565,000	1,565,000
5	Labour	7,500,000	7,800,000	7,420,000	7,420,000
II	Income	32,130,000	31,375,000	62,670,000	55,656,000
1	Yield (kg)	6,426	6,275	10,445	9,276
2	Price (VND)	5,000	5,000	6,000	6,000
III	Net return (Total income-total expenditure)(VND)	13,137,000	11,584,000	46,678,000	39,424,000

- Results in table 30 initially showed that tomato production in compliance with VietGAP facilitated farmers to save pesticide and labour costs. Farmers could get a net return of VND 13 million per 1,000 m² under VietGAP tomato cultivation in summer season, while it was VND 11.5 million per 1,000m² under traditional one. In winter – spring season, tomato production gave high yield and marketable yield, thereby bringing higher profits with VND 46.678 million by VietGAP tomato and VND 39.42 million by tradition tomato production.
- Thus, the above results indicated that if the application of the tomato production protocol in compliance with VietGAP, it would ensure ensure product quality, hygiene and safety as well as reduce both pesticides and labor costs, bringing higher economic efficiency than traditional tomato production. Therefore, vegetable production in compliance with VietGAP is a totally right direction to bring many benefits to both producers, consumers and to communities

4.3.2.2. Cabbage

- Cabbage belongs to temperate vegetable group, requiring suitable temperature for head formation of 15-20⁰C; temperature of >25⁰C and <10⁰C will reduce the growth of cabbage. A huge advantage of Lam Dong in general and Don Duong in particular is that cabbage could be grown yearround. However, winter – spring season has the most favorable climatic condition for cabbage growth and development.
- Observation of growth characteristics of Nova variety in the demonstration showed that it had good and stable growth and development. However, its development differs depending on technical conditions. Anna cabbage can be harvested at 90 days after transplanting with an average plant height of 28cm and canopy width of 63.52 cm, the number of outer leaves was around 15.34 and the number of inner leaves was about 59.02. Due to better care conditions, percentage of harvested plants reached 96.4%, even 90% at some households' fiend. In the summer conditions, high temperature and high humidity shortened the growth duration of cabbage and affected the yield components such as number of leaves, head size and percentage of harvested plants (table 31, 32).

Table 31. Growth chatacteristics of Nova cabbage variety in the demonstration in winter – spring 2011-2012

No	Household name	Days from transplanting to		Plant height (cm)	Canopy width (cm)	No of outer leaves (leaf	No of inner leaves (leaf	Percentage of harvested plants (%)
		Leaf spread ing	Harves ting					
1	Thai Ke Thanh	26	90	28.53	65.5	15.4	59.5	98.5
2	Huynh Tan Cong	27	90	27.74	63.3	15.7	59.3	97.8
3	Nguyen Huu Hanh	26	90	28.35	62.7	15.5	58.9	96.3
4	Tran Van Tinh	26	90	28.52	66.3	15.4	59.7	98.8
5	Nguyen Da	28	90	26.35	59.8	14.7	57.7	90.6
	Mean value	26.6	90	27.89	63.52	15.34	59.02	96.4

Table 32. Growth chatacteristics of Nova cabbage variety in the demonstration in summer 2012

No	Household name	Days from transplanting to	Plant height	Canopy	No of outer	No of inner	Percentage of
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		Leaf spreading	Harvesting	(cm)	width (cm)	leaves (leaf)	leaves (leaf)	harvested plants (%)
1	Thai Ke Thanh	24	85	25.53	57.5	15.2	54.5	90.5
2	Huynh Tan Cong	25	85	24.74	58.3	15.3	56.3	87.8
3	Nguyen Huu Hanh	24	85	25.35	58.7	14.9	55.9	92.3
4	Tran Van Tnh	24	85	25.52	60.3	14.8	56.7	93.8
5	Nguyen Da	25	85	23.35	54.8	14.7	55.7	86.6
	Mean value	24.4	85.0	24.9	57.92	14.98	55.92	90.2

Main pest and diseases prevalence.

- Green worm, diamond back moth, soft rot and web blight are the dangerous pests and diseases influencing yield and quality of cabbage in general and cabbage in Lam Dong in particular, especially recently developed root club disease as a serious disease, greatly affecting the quality of the cabbage growing areas in Lam Dong.

Table 33: Main pest and disease prevalence of Nova cabbage variety in the demonstration in winter spring 2011-2012

Code	Households name	Web blight (Scale)	Soft rot (%)	DBM (number/plant)		Green worm (Scale)	Root club (%)
				15-30 DAT	40-60 DAT		
1	Thai Ke Thanh	1	1.33	0.8	0.5	+	0.3
2	Huynh Tan Cong	1	1.67	0.9	0.7	+	0.2
3	Nguyen Huu Hanh	1	1.67	1.1	0.8	+	0.2
4	Tran Van Tinh	1	0	0.7	0.3	+	0
5	Nguyen Da	1	3.53	2.2	1.2	+	3.2
	Mean value	1	1.64	1.14	0.70	+	0.78

Table 34: Main pest and disease prevalence of Nova cabbage variety in the demonstration in summer 2012

Code	Households name	Web blight (Scale)	Soft rot (%)	DBM (number/plant)		Green worm (Scale)	Root club (%)
				15-30 DAT	40-60 DAT		

1	Thai Ke Thanh	1	0.42	1.2	2.5	++	3.3
2	Huynh Tan Cong	1	0.48	1.4	3.7	++	4.2
3	Nguyen Huu Hanh	1	0	1.5	0.8	++	0
4	Tran Van Tinh	1	0	1.4	3.3	++	8.3
5	Nguyen Da	1	0.65	2.5	4.6	++	8.5
	Mean value	1	0.31	1.6	2.98	++	4.86

- Assessment of main pest and disease prevalence on cabbage plants indicated that it was infected by soft rot (1.64%), web blight (scale 1) at low level and percentage due to technical guidance, timely pesticide spraying measures. Root club disease has been newly occurred in Lam Dong cabbage growing zones in recent years, but it is very difficult to control, so farmers were technically trained to do good soil sterilization, purchasing good seedlings and processing seedlings before transplanting to limit the damage of the disease at about 0.78% of which Mr Nguyen Da field had the highest infected plants at 3.2% and vice versa Mr. Tran Van Tinh field had no infected plants
- Diamond back moth (DBM) eats and destroys entire leaves of most crucifereous plants, seriously damaging at seedling stage or newly planted seedlings. Larvae eat the leaves, except for the leaf veins to make leaved spotted, distorted, facilitating certain diseases develop. When a high density of DBMs and serious damage, damaged leaf area is greater and the leaves may be completely destroyed to make serious damage if the weather is hot and dry.
- Monitoring results of the DBM damage in the demonstration suggested that households that implemented relatively well the field monitoring, pesticide spraying had the low level of DBM damage. For DBMs, at 15-30 days after transplanting it was necessary to spray pesticides to control DBMs to reduce DBM density which was 1.14 number/plant and about 0.7 number/ plants at rolling stage (40 - 60 days after transplanting). This is a safe threshold for farmers to use biological organic chemicals to spray with low MRLs to minimize pesticide residues in products.
- In both planting seasons, the summer cabbage was under more pressure of diseases than winter-spring one. DBM is also an important pest for cabbage in this season. In addition to DBMs, the cabbage root club

disease also causes yield decrease for recent years, particularly it was occurred in some demonstration fields.

Yield and yield components

- The yield is generated by the yield components and farming techniques have a major effect on yield including effectiveness of pest control of used pesticides.

Table 35. Yield and yield components of Nova cabbage variety in the demonstration in winter spring 2011-2012

Code	Households name	Plant weight (kg)	Head weight (kg)	Marketable yield (ton/ha)	Actual yield (ton/ha)	Percentage of marketable products (%)
1	Thai Ke Thanh	3.92	3.23	125.75	126.68	99.27
2	Huynh Tan Cong	3.64	2.83	105.64	106.85	98.87
3	Nguyen Huu Hanh	3.85	2.95	112.52	113.78	98.89
4	Tran Van Tinh	3.78	3.16	119.97	120.32	99.71
5	Nguyen Da	3.43	2.44	92.51	95.67	96.70
	Mean value	3.72	2.92	111.28	112.66	98.69

Table 36. Yield and yield components of Nova cabbage variety in the demonstration in summer 2012

Code	Households name	Plant weight (kg)	Head weight (kg)	Marketable yield (ton/ha)	Actual yield (ton/ha)	Percentage of marketable products (%)
1	Thai Ke Thanh	3.1	2.23	82.51	73.32	88.86
2	Huynh Tan Cong	3.0	2.20	79.2	67.31	84.99
3	Nguyen Huu Hanh	3.2	2.45	90.65	82.39	90.89
4	Tran Van Tinh	2.8	2.15	75.25	62.77	83.42
5	Nguyen Da	2.8	1.97	66.98	54.4	81.22
	Mean value	2.98	2.20	78.92	68.04	85.87

- Monitoring results of the demonstration showed that cabbage cultural practices of farmers in Thanh Nghia Cooperatives reached relative high levels, which was reflected by the marketable yield and percentage of marketable products. During the winter – spring season in 2011-2012, the mean marketable yield reached approximately 111.28 tons/ha, particularly the highest one of about 120-126 tons/ha 99% of marketable products. It could be said that location with technical application and the highest cabbage yield in the whole country should be planned and developed.

Table 37. Results of cabbage quality analysis

No	Criteria	Analyzed results		MRLs
		Winter – spring	Summer	
1	Abamectin	Not detected	Not detected	(0.02)
2	Benomyl	Not detected	Not detected	(0.02)
3	Chlorpyrifos	Not detected	Not detected	(0.1)
4	Cypermethrine	Not detected	Not detected	(0.05)
5	Metalaxyl	Not detected	Not detected	(0.5)
6	Deltamethrin	Not detected	Not detected	(0.5)
7	Arsen (As) mg/kg	0.120	0.165	1.0*
8	Cadimi (Cd) mg/kg	0.004	0.046	0.1*
9	Copper (Cu) mg/kg	1.050	0.85	30*
10	Mercury (Hg) mg/kg	0.006	0.008	0.05*
11	Lead (Pb) mg/kg	0.045	0.018	0.3*
12	Nitrate (NO ₃ ⁻) mg/kg	145	138	150*
13	Salmonella TB/g	Not detected	Not detected	0*
14	E.coli TB/g	Not detected	Not detected	10*
15	Coliform TB/g	30	35	200*

- Table 35 showed that residues of pesticides and pathogenic microorganisms in the analyzed samples of cabbage in the demonstrations in both planting seasons were not detected. Residues of heavy metals in vegetable products was found, however under the MRLs, cabbage products completely met quality, hygiene and safety standard.



Economic efficiency of cabbage production in the demonstrations

Via the analysis results of economic efficiency of cabbage production demonstration we found that application of cabbage production protocols in compliance with VietGAP has helped producers in term of savings of pesticide and labor costs that enables effective economic efficiency of cabbage production in the demonstration which was higher than the traditional one.

Table 38 : Economic efficiency of cabbage production in the demonstrations

No	Items	Spring summer		Winter spring	
		In compliance with VietGAP	Traditional production	In compliance with VietGAP	Traditional production
I	Expenditure (VND)	9,148,000	9,392,000	9,099,000	9,290,000
1	Seedlings	680,000	680,000	680,000	680,000
2	Fertilizers	3,042,000	3,042,000	3,042,000	3,042,000
3	Pesticides	1,106,000	1,350,000	1,057,000	1,248,000
4	Labour	4,320,000	4,320,000	4,320,000	4,320,000
II	Income	13,608,000	12,892,000	27,820,000	25,190,000
1	Yield (kg)	6,804	6,446	11,128	10,076
2	Price (VND)	2,000	2,000	2,500	2,500
III	Net return (Total income-total expenditure)(VND)	4,460,000	3,500,000	18,721,000	15,900,000

4.3.3. Field conference to introduce demonstrations of safe tomato and cabbage production in compliance with VietGAP

Date: 18/6/2012

Location: Demonstrations of Thanh Nghia Cooperatives and meeting at CPC headquarter

Participants: 66 including:

- International Cooperation Department - MARD
- DARD Lam Dong: Crop Production Division, Quality Control Sub Department of agricultural, Forestry and Fishery products, PPSD, Extension Center.
- Don Duong district: District Agricultural Division
- Thanh Nghia Cooperative and Thanh My commune: leaders and staff
- Farmers of Thanh Nghia Cooperative
- Fruit and Vegetable Research Institute
- Ngoc Yen Minh Company

The conference visited demonstrations in the field of Thanh Nghia Cooperatives, vegetable handling workshop of Ngoc Yen Minh company At the meeting room, participants listened to the project results implemented in Lam Dong province in term of training and demonstration establishment. The speeches by local leaders and farmers were good reviews and they looked forward to expanding the project activities in terms of size and plant species. The conference also proposed to organize more training courses for farmers, and to promote linkage between producers, processors and consumers.

PART 5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion:

After a period of project implementation in Hiep Cuong commune - Kim Dong district - Hung Yen province and HAVECO company; Thanh Nghia cooperatives - Don Duong district - Lam Dong province; 19/5 Agriculture and Service Cooperatives - Moc Chau district - Son La province, demonstrations have been established and carried out on schedule, meeting project requirements, obtaining positive results, encouraging farmers to participate in production.

- The project has supported project locations to build some facilities such as handling, packing houses, toilets, sinks/tanks to store organic fertilizers and pesticide containers.

- Farmers understood protocols and implementing method of safe vegetable production in compliance with VietGAP

- Due to training and guidance, closely technical instruction with the desire to learn of farmers, crops in the demonstrations had growth and development with high yield, meeting quality assurance requirements, providing quality and safe products for consumers.

- Products of the demonstrations met safe vegetable standards and traceability

- Production of safe vegetables in compliance with VietGAP helped farmers to reduce pesticides as well as labor costs to make products with 20-30% higher economic efficiency than conventional products.

- Product appearance, quality is satisfactory for supermarket sales, initially establishing linkage between producers and processors and distributors. The Metro signed a contract to purchase tomato and chayote products at average amount of 5,000/kg/month in Son La. HAVECO in Hung Yen purchased project products to process and export to Russia and France.

- The project implementation have changed the appearance of any agricultural production based on traditional practices, workers have been slowly changing habits in production: regular field hygiene, fertilizing, spraying plants based on right protocols and right principles towards to a modern, safe and sustainable agriculture.

- The project's activities have contributed to expanding production, raising awareness, building trust for farmers in safe vegetable production and environmental protection.

- Through the field conferences, and propaganda through the mass media, demonstration results have been replicated to the producers in the project communes and other nearby villages.

- The experts and advisers of the project were very closely managed with local authority, consulting and directing the local officers to effectively bring good demonstrations.

5.2. Recommendations

- In addition to maintaining the production demonstrations in the project site, it is needed to multiply the demonstrations in other locations in the area of the project provinces or other provinces with a larger scale in other various crops.

- To support building and upgrading infrastructure, inland transportation system, improving system of ditches/canals within the demonstrations. To support equipment and machinery/tools: multifunctional and small tillage machine, pesticide spraying machine...

- To support for rapid assay equipment with good quality for provincial mission group (rapid assay of Content of NO₃⁻, pesticide residues ...) to serve and fulfill the assigned tasks.

- To enhance the information and dissemination: Introduction and dissemination of results of the demonstrations to other locations inside and outside project province. To invite radio and television, to make video clips to reports on the province's information system about demonstrations of safe vegetable production in the project communes.

- To promote marketing of products so that consumers will be able to distinguish the difference between vegetables traditionally produced and vegetables produced in compliance with VietGAP.

- To support the design, printing of product packaging, quality registration and quality barcodes for products, registration of trademark and product promotion.

- The State and other functional agencies should develop policies to support the development of production in compliance with VietGAP.

Hanoi, July 2012

Prepared by

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