GOOD AGRICULTURAL PRACTICES FOR TOMATO AND CUCUMBER PRODUCTION IN VIETNAM

Tran Khac Thi [1],Pham My Linh[1], Ngo Thi Hanh[1]
Robert Spooner Hart[2], Oleg Nicetic[2]

I. Introduction

Vegetable production in Viet Nam has increased by around 30% in the last decade with an area of 643,970 ha planted in 2006. Average productivity in 2005 was 14.99 tons/ha with the total annual production exceeding 9.655 million tons. Higher production has allowed increased domestic per capita vegetable consumption as well as export of a range of key vegetables. Vegetables constitute 60% of the total value of Vietnamese exports of fruit, vegetables and ornamental plants, which had an average annual value of US$224.4 million in the period 2000-2004 with a target of US$690 million to be reached by 2010. Tomato and cucumber and other cucurbits are the most stable of vegetable export products. Tomato can be produced for 9 months of the year and provides a much higher net return than rice (30 million VND/ha for tomato vs 15 million VND/ha for rice), making tomato production a popular choice for farmers.

Despite the substantial and largely successful development of vegetable production in Viet Nam, vegetable farming still faces considerable problems, particularly quality production of vegetable seed and seedlings, and vegetable food safety. In Viet Nam approximately 8000 tones of vegetable seeds are planted every year. More than half of these seeds are imported, 41% is produced by local farmers and only 7% is supplied by local seed companies. Seeds produced by local farmers are commonly of poor quality, resulting in very low yield while imported seeds cost the Vietnamese economy millions of dollars. Vegetable seedling production in nurseries or by farmers often uses very simple technology with high labour costs, which has further contributed to low farm yield and production efficiency. With the increased intensity of vegetable production, concerns about vegetable food safety have escalated, especially the high quantity of pesticides (10 -12 times/ plant cycle) and fertilizers applied to small plots of land used for vegetable production, in an attempt to boost production, particularly in peri-urban areas. The lack of pest and disease tolerant/resistant varieties has added to this problem. Recent studies have found that in Hanoi 9% of all vegetable samples exceeded pesticide residue limits by 5-10 times and 7% of samples were found to have residues of banned pesticides. As a result, there are annually thousands of food poisoning cases due to eating vegetables with high pesticide residues (MALICA, 2003). In addition, pesticide overuse has resulted in increased pest damage caused by natural enemy destruction and development of pesticide resistance.

Good agricultural practice (GAP) principles, together with results of several international projects, in particular CARD project 004/04VIE ‘Improving the safety and quality of Vietnamese vegetables through research and capacity building in quality assurance, post-harvest management and high technology protected cropping systems”, ACIAR project CS2/1998/078 ‘Sustainable Integrated Management of Whiteflies as Pests and Vectors of Plant Viruses in Asia (Phase 2)’ and Phase III of the Tropical Whitefly IPDM Project coordinated by the Centro International de Agricultura Tropical

[1] Fruit and Vegetable Research Institute, Hanoi

[2] University of Western Sydney, Australia

(CIAT) in Colombia, provide a solid base for improvement of vegetable seed and seedling production that will result in increased production of safe, high quality vegetables. This article briefly presents some initial results of CARD025/06VIE project: "Improvement of Vietnamese vegetable production using Good Agricultural Practices (GAP) principles for seed and seedling production and superior hybrid varieties" with duration of 2007-2009 that aims at: based on research results, carrying out demonstrations of tomato and cucumber seed, seedling and field production using IPM incorporating varieties resistant/tolerant to TYLCV or mildew diseases; and organizing seed production of these varieties to release to large scale production using GAP principles.

II. Methodology

2.1. Baseline study on tomato and cucumber seedling production conducted in 3 regions of Vietnam:

- Red River Delta: Hung Yen, Vinh Phuc provinces
- Central Coast: Quang Nam, Da Nang provinces
- Central Highland: Lam Dong province

Objective: to survey current situation, technical procedures, and markets, for these two vegetable crops.

Methodology: to distribute questionnaires to tomato and cucumber producers and State Management Agencies, 15 questionnaires for each site using PRA.

2.2. Evaluation trials of tomato and cucumber varieties:

Trials were conducted in three regions:

Fruit and Vegetable Research Institute (FAVRI) - Red River Delta
Hue University of Agriculture and forestry (HUAF)- Central Coast
Dalat Potato, Vegetable and Fruit Center (PVFC) - Central Highland

Materials included: 13 hybrid tomato lines from AVRDC - the World Vegetable Center and 10 hybrid cucumber lines from FAVRI, foreign seed companies and Southern Seed Company (SSC)

Methods: The trials were designed following RCBD with 3 replications.
Characteristics to be observed:

- Growth and development characteristics
- Flowering and fruit setting characteristics.
- Insect pests and diseases
- Yield components and yield (tons/ha).
- Morphological characteristics and fruit quality

2. 3. Workshop on GAP for tomato, cucumber seed, seedling and field production

The workshop was conducted in Hanoi in December 2007 with attendance of 42 participants from state management agencies, research institutes, universities and producers.

2. 4. Training of Trainers (TOT) and workshops on tomato, cucumber seed and seedling industry

Two TOTs were organized (April, June 2008) at Hanoi and Da Lat, with attendance of 40 participants from Plant Protection Sub Departments from the targeted project provinces.

III. Results and discussion

3. 1. Results of tomato and cucumber survey (baseline study)

Table 1. Results of tomato and cucumber production survey

No	Implementing duration	Activities	Implementing provinces	Implementing agencies
1	June - July 2007	Survey on situation of tomato, cucumber seed and seedling production and their markets	- Hung Yen, Vinh Phuc - Quang Nam, Da Nang - HCM city, Lam Dong - Wholesale markets in surveyed areas	University of Western Sydney (UWS), Fruit and Vegetable Research Institute (FAVRI), Hue University of Agriculture and Forestry (HUAF), Institute of Agricultural Science in the South (IAS), Dalat Potato, Vegetable and Fruit Center (PVFC), Division of Agriculture and Rural Development under provincial DARDs .
2.	June 2008	Survey on tomato and cucumber farmers	- Hung Yen, Vinh Phuc - Quang Nam, Da Nang - HCM city, Lam Dong	University of Western Sydney (UWS), Fruit and Vegetable Research Institute (FAVRI), Plant Protection Department (PPD), Plant Protection Sub Departments and farmers involved in FFSs in surveyed areas.

The survey results showed that there was a significant difference in vegetable seed and seedling production between the different tomato and cucumber production areas. In the Central Coast (Quang Nam, Da Nang provinces), seed and seedling production was done entirely by farmers themselves on a small scale to supply their household demand. This meant that seedling production was around 500-several thousand. Production was not in a net house, and seedlings were not grafted, despite bacterial wilt being recognised as a problem. The most common tomat variety grown was the local variety BOM In the Red River Delta, all three provinces had seedling production on a medium scale (Van Lam district - Hung Yen province and Vinh Tuong district - Vinh Phuc province). Here, seedling producers produced between several hundred thousand to several million tomato seedlings, generally to supply growers within their province. Production was in a mesh or shadehouse, but in the ground. Grafting was not practised. Cucumbers were generally sown at seed, and not transplanted. A wide range of varieties were produced with F1 Hybrids VL 2000, VL 2004 and BM 199 being the most common. In Lam Dong province in the Central Highlands specialized and professional seedling production was undertaken on a large scale. Seedling producers commonly produced from several million -12 million tomato seedlings per annum, with all producers growing other vegetable seedlings too.. All producers had large net houses, and seedling production was in trays. Usually, more than 40% of tomato seedlings were grafted to bacterial wilt-resistant tomato rootstock. The most commonly produced tomato variety was Anna (Seminis)..Seedlings were sold mainly in Lam Dong, but orders were also transported outside the province.

However, with few exceptions, even for medium to large scale seedling production areas, application of GAP principles has not been adopted. Seedling production enterprises/facilities often didn't keep records of production processes, were not concerned about the origin of input materials such as seeds, fertilizers, pesticides, etc and, especially, did not abide by regulations for safe utilization of pesticides.

In addition a survey on tomato and cucumber markets in the Hanoi wholesale markets indicated that out of six criteria: variety, source, appearance, taste, labelled safe production, storage ability, storage ability was the most important for tomato wholesalers, with appearance next, and safe production last. For cucumbers, the most important criterion was appearance, followed by variety and source. Again, safe production was last. Tomatoes commonly sell at the markets at around 4000-5000 VND/kg. Highest prices are received in June-August, when they are in shortest supply. Cucumbers sold for lower prices than tomatoes, at between 2000 and 2500 VND/kg. Shortages occurred in August-September.,

3. 2. Evaluation trials of tomato and cucumber varieties/lines in project sites

Table 2. Evaluation trials of tomato and cucumber varieties/lines in regions

Seasons	Crops	FAVRI	HUAF	PVFC	IAS
Spring - Summer 2007	Cucumber	x	-	-	-
	Tomato	-	-	-	-
Winter 2007	Cucumber	x	x	-	-
	Tomato	x	-	-	-
Spring - Summer 2008	Cucumber	x	x	-	x
	Tomato	x	x	x	-

A total of evaluation trials of tomato and cucumber varieties were attempted in the 3 project regions. In the Central Highland region, due to climatic condition and growing habit, only tomato was grown in this region. Evaluation trials of cucumber for Central Highland were conducted in Cu Chi district - HCM city by the IAS.
Below is list of tomato varieties for evaluation trials in three regions

Table 3. List of tomato varieties for evaluation trials in FAVRI, PVFC, HUAF

STT	Name of varieties	**Source**
1	WVCT1	AVRDC
2	WVCT2	AVRDC
3	WVCT3	AVRDC
4	WVCT4	AVRDC
5	WVCT5	AVRDC
6	WVCT6	AVRDC
7	CLN2777F	AVRDC
8	WVCT8	AVRDC
9	WVCT9	AVRDC

Table 4. List of cucumber varieties for evaluation trials in FAVRI, IAS, HUAF

No	Name of varieties	Source
1	CV1	FAVRI
2	CV5	FAVRI
3	CV7	FAVRI
4	CV8	FAVRI
5	CV11	FAVRI
6	CV15	FAVRI
7	Ninja 179	FAVRI
8	Amata 765	FAVRI
9	Trangnong 20	FAVRI
10	Hung Thinh	FAVRI

The check varieties for evaluation trials above were commonly grown varieties in the region.

The trials evaluated and selected the tomato and cucumber varieties with pest and disease resistance, high yield, good quality, suitable for customers' tastes in the region as well suitable for growing habit in the production area. The promising varieties in three regions will be used to establish farmer field schools (FFSs) under facilitation of trainers of PPSD in provinces.

3.3. Workshop on GAP for tomato, cucumber seed, seedling and field production.

No	Implementing duration	Activities	Implementing provinces	Implementing agencies
1	3-5 December 2007	Workshop on GAP for tomato, cucumber seed, seedling and field production	Ha Noi	Fruit and Vegetable Research Institute (FAVRI), Hue University of Agriculture and Forestry (HUAF), Institute of Agricultural Science in the South (IAS), Dalat Potato, Vegetable and Fruit Center (PVFC), Division of Agriculture and Rural Development under provincial DARDs
2.	June 2008	Survey on tomato and cucumber farmers	- Hung Yen, Vinh Phuc - Quang Nam, Da Nang - HCM city, Lam Dong	University of Western Sydney (UWS), Fruit and Vegetable Research Institute (FAVRI), Plant Protection Department (PPD), Plant Protection Sub Departments and farmers involved in FFSs in surveyed areas.

The workshop was held in Hanoi with attendance of 42 participants from project implementing agencies and supporting institutions such as Ministry of Agriculture and Rural Development (MARD), Vietnam Academy for Agricultural Science; with 11 presentations related to workshop objective and activities. After presentations was discussion with 3 key topics:

Topic 1: What GAP framework is the most appropriate (ASEANGAP, FRESHCARE, GLOBALGAP) for GAP manual

4 groups were divided among participants for discussion

Questions raised for discussion of this topic included:

+ Why develop GAP?
+ What is GAP established for?
+ What GAP framework is the most appropriate? **(**ASEANGAP, FRESHCARE, GLOBALGAP)

Topic 2: What the differences between GAP for seed and seedling in comparison to fresh production

With the same divided groups, participants focussed on discussing:

- What are the differences between tomato and cucumber seed, seedling and field?
- Which differences we don't have information?

Topic 3: How to write GAP manual

Groups discussed establishing framework of GAP for tomato and cucumber. Lastly, it was developing tasks, assigning the tasks and defining time for writing of GAP manual

3.4. Training of Trainers (TOT) and workshop on safe tomato, cucumber seed and seedling industry

In the framework of project, in April 2008, the first TOT was held at the FAVRI headquarter with attendance of 30 participants from PPSD in 9 provinces in the Red River Delta and Central Coast. These trained participants will be resource persons and facilitators for project farmer field schools held in winter 2008. In June 2008, another similar TOT was held in Da Lat city - Lam Dong province with attendance of 10 participants from PPSD of HCM city, Lam Dong, Dak Lak. As well as talks and practical sessions on safe vegetable production, seedling production, grafting, and GAP principles and practice, the trainers developed the curriculum for the up-coming FFS.

The first industry workshop on safe tomato, cucumber seed and seedling production was held in Lam Dong, with 30 participants attending. This workshop, most of which was held on the farm of Lam Dong's best vegetable seedling producer, emphasised advantages and disadvantages of safe vegetable production industry, solutions to solve disadvantages and promote advantages of vegetable industry in general and tomato/cucumber in particular, and best practice in tomato seedling production, including grafting. .

Survey on tomato and cucumber farmers before establishing/opening GAP-FFSs

In June 2008, with the involvement of the PPD staff, FAVRI staff accompanied by UWS staff carried out a farmer survey in 4 provinces (Hung Yen, Vinh Phuc, Quang Nam and Da Nang) to be used as a baseline prior to establishing the project's FFSs. Ten farmers were selected in each province following PRA method. Based on the surveyed results, the survey team (project team and PPD team) agreed that FFSs would be done only on either tomato or cucumber in some provinces; while some other provinces, FFSs would be done on both tomato and cucumber. For FFSs on tomato, farmers in Central Coast (Quang Nam, Da Nang) will conduct comparative trials on growth,

development, soil-borne pest/disease resistance (bacterial wilt disease) and yield of tomato grafted on eggplant rootstocks and non-grafted tomato.

For the Red River Delta, apart from problems of soil-borne diseases, tomato land is usually flooded, therefore, it was decided that FFSs on tomato in this region would be on tomato grafted on eggplant rootstock. Farmers will be actively involved in observation of differences in yield, growth, development and resistance between grafted and non-grafted tomato.

IV. Conclusion:

In order to have real foundation to develop GAP manual, the project activities have been implemented and some conclusions can be summarised as follows:

1. Tomato and cucumber farmers in Vietnam generally do not know the concepts and principles of production using GAP.
2. Evaluation trials have identified some promising tomato and cucumber varieties with good growth, high yield, good quality and disease resistance. Utilization of disease-resistant varieties is one of important principles in production using GAP, although it is clear that other pests and diseases beyond those initially targeted are also important
3. Following the GAP workshop in December 2007, the team decided to use the Global GAP framework for the manual, even though it was not seen to be highly appropriate. However, with the announcement of Viet GAP in early 2008, we have agreed to adopt VietGAP, because tomatoes and cucumbers are likely to be produced for local or within-country sale, and not for export to Europe, and it is seen as more appropriate for the production conditions and levels of Vietnamese vegetable farmers.
4. The need for GAP with tomato and cucumber production is to incorporate information from Ministerial Standards for seedling production, together with safe vegetable production of fruity vegetables. In addition, we are making sure that we access the most appropriate forms for record keeping in line with VietGAP. We believe that the FFSs will be a useful way for Vietnamese farmers haven't previously had access to GAP to understand and develop towards GAP, especially in record keeping and safe use of pesticides..