

# Bottlenecks in Thai Agro Logistics

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## Colophon

This project is part of the program “BO Cluster International, Bilateral Projects”. BO Cluster International is a program financed by the Dutch Ministry of Agriculture, Nature and Food Quality. It aims to contribute to economic development and poverty reduction in developing countries, with special attention to the strengthening of sustainable agriculture and production chains, and nature management.

Note: within this project a confidential edition (1106) was published in February 2010. This report (number 1106-A) is the public edition and therefore not all the activities, findings and results are described. However the topics and conclusions relevant for the sector and policy making will be found in this report.

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## Summary

### Background

This report describes the results of the project 'Bottlenecks in Thai Agro Logistics' (BO-10-006). The objective of the project was to analyze and wherever possible optimize parts of the Thai agro logistics. Major goal was to enhance international supply chains of exotic fruits since bottlenecks in the Thai agro logistics have a negative influence on the productivity of the agricultural sector.

### Results

Despite its potential, Thailand is not doing very well yet in penetrating overseas markets. Regardless of large quantity, high diversity and general attractiveness of Thai tropical fruit supplies, several constraints exist. According to importers, exceedingly rigid maximum residue levels of pesticides are an important bottleneck. Examples of other agro logistical bottlenecks are suboptimal post harvest processes and a lack of conditioning throughout the agro chain.

To be able to overcome some of the bottlenecks, new logistic concepts are required. Therefore several logistical concepts were designed and discussed with commercial parties and other stakeholders. In cooperation with an importer a pilot was carried out in which the sea freight of cut pomelo's was simulated. It became clear that the implementation of new concepts results in new challenges and the need for tailor made logistical solutions.

### Further research

> Insight in the strengths and weaknesses of the agro logistic in Thailand are in this project gained through extensive desk research, expert knowledge, experience acquired during other projects (i.e. "Integrated Supply Chain Management of Exotic Fruits from the ASEAN region", Asian-Invest Programme) and stakeholders interviews. But most of the knowledge, insight and experience is directly related to experts, organizations, et cetera in The Netherlands. Unfortunately in this project we did not manage to arrange a participatory workshop as planned. Although some interviews with Thai stakeholders were held, bringing together the needed stakeholders requires a good network and exhaustive planning which was not feasible within the timeframe of this project.

However the involvement of Thai partners, to discuss agro logistical challenges and to exchange knowledge is an important aspect in a process of transition, as required. Therefore the organization of a participatory workshop which is an excellent and proven method to support this, should be one of the first activities that should take place in the process of fact-finding (from a Thai point of view) and optimizing parts of the Thai agro logistics.

> Pilots offer a great chance to acquire practical insight in the implementation of new concepts. Ideally pilots result in a blue print from which a sector as a whole can benefit. Pilots will be of importance in further research to show the possibilities for new agro logistic concepts.

Additional research is also needed for:

During the several interviews with stakeholders the macro economical concept that focuses on Thailand as a hub for the exotic fruit and vegetal world market kept coming up during these talks.

The global idea of this concept is that Thailand, a producer of considerable amount of exotic fruit, vegetables and flowers both in volume as varieties, could develop towards a regional market place or hub were products not only from Thailand but also from regional producers are brought to this hub were (potential) buyers are also present.

By bringing both supply and demand together at one place suppliers have the chance to see the products of their competitors and therefore have the chance and possibility to learn form each other which could result in lifting to general level of product quality (just like the influence of Aalsmeer and the overall product quality of flowers).

Because this aspect was not a part of this project no initiatives were taken to elaborate on this topic. However, we as a project team believe that this concept is promising and therefore an interesting topic for further research.

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# **1 Introduction**

## **1.1 Problem Description**

This report outlines the results of the project 'Bottlenecks in Thai Agro Logistics'. The project was financed by the Dutch Ministry of Agriculture, Nature and Food Quality (LNV) and was executed during 2009. Participating partner outside Wageningen UR was the Royal Netherlands Embassy (Agricultural Attaché) in Bangkok. The objective of the project was to analyze and wherever possible optimize the Thai agro logistics. Major goal was to enhance international supply chains of exotic fruits since bottlenecks in the Thai agro logistics have a negative influence on the productivity and income of the agricultural sector.

## **1.2 Research Methodology**

Several steps were taken in order to fulfill the research objective. The first step comprised of listing the Thai bottlenecks in agro logistics. This was accomplished by means of a literature study and interviews with several Dutch importers of fruits from Thailand.

It appeared that despite its potential, Thailand is not doing very well yet in penetrating overseas markets. The next step included the design of different logistic concepts to overcome some bottlenecks in agro logistics. These concepts were tested for feasibility by interviewing Dutch importers and logistic companies (forwarders). During this project and as a result of the interviews with several stakeholders an international importer showed interest in simulating one of the logistic concepts.

## **1.3 Structure of the Report**

This report consists of 4 chapters. Chapter 2 focuses on listing the Thai limitations in agro logistics. Chapter 3 is about the design and examination of logistic concepts. Chapter 4 summarizes the conclusions of the project and elaborates on possible further activities and research.

## 2 Bottlenecks in Agro Logistics

### 2.1 Introduction to Bottlenecks in Agro Logistics

This chapter describes the results of the desk study concerning limitations in Thai agro logistics. Results of the interviews with Dutch importers are also described. Frequently mentioned by the importers was the problem of Thai products exceeding maximum residue limits (MRL) for residues of pesticides. Therefore the chapter ends with an elaboration on this specific problem.

### 2.2 Thai Exotic Fruit Sector

#### 2.2.1 *Fruit Chain*

The Thai fruit industry is typically composed of a variety of small and medium parties active in the supply chain for fresh and processed Thai fruit for domestic consumption or for trade in the export markets in Europe or Asia (Wageningen UR & National Food Institute Thailand, 2006). Most of them are strongly specialized in terms of product or function, e.g. fruit production, post-harvest handling or fruit processing. Almost 95 percent of growers belong to grower groups that hold formal contracts with manufacturers / export companies (Chiang Mai University, 2009). It is noted that manufacturers/packing houses and exporters in many cases are different branches of the same companies. These actors control 72 percent of the added value in the chain and are quite powerful in relation to grower groups as they hold access to the national and international markets (Chiang Mai University, 2009).

#### 2.2.2 *Fruit Export*

While Thailand is recognized as a country that produces a variety of unique and great-tasting fruits, it has not been very successful in penetrating overseas markets (Chulalongkorn University Thailand, 2008). Up to now, export markets are regarded as alternative sources of sales during times of oversupply in the domestic market. This results in problems related to product quality, low bargaining power and poor brand recognition. Inefficiencies in the logistics environment within the fruit export sector may also affect the international competitiveness. All these factors have hindered the ability of Thailand's fruit growers to achieve high market shares when compared with their competitors elsewhere in the world.

To enhance the competitiveness of Thai fruit exports in world markets drastic change needs to take place in terms of moving away from conventional export concepts towards a more market-oriented strategy (Chulalongkorn University Thailand, 2008). There, also, needs to be a commitment to reform (production) processes throughout the supply chain.

### 2.3 Results Desk Study

Despite large quantity, high diversity and general attractiveness (color, aroma, smell) of Thai tropical fruit supplies, there are several constraints. According to Chiang Mai University four types of bottlenecks exist. Bottlenecks concerning certification, infrastructure & logistics, harvest technology and enabling environment.

Type of bottleneck	Bottleneck
Certification	Thailand does not have a consistent and well implemented policy on residue/chemical control.
	Food certification and standards assurance are not in line with leading requirements, requested by the private sector in the EU.
	Thai GAP is not accepted by the majority of the EU traders.
	Dual standards, with which the exporters have to deal, are increasing costs and do not contribute to increased competitiveness.
Quality infrastructure & logistics	High transportation costs because of the dependency of air freight shipment due to the limited shelf life of fruits
	High costs of distribution due to substantial distances.
	Limited number of airlines.
	Limited cargo space and low priority for perishable products.
	Closed rather than open sky.
	Cargo space is fully occupied on the way to Europe but empty on the way back.
Post harvest technology	Farm based cooling systems (hydro cooling, force air cooling, vacuum pre-cooling) are not widespread and only selectively applied.
	Facilities at packing houses (pre wash, waxing, pre-cooling) are limited.
	Deficient logistics and quality infrastructure (cool chain refrigerated truck, refrigerated warehouses, cold storage room at the airport) result in shorter shelf life and product quality.
	For commercial introduction of advanced technologies appropriate technology transfer is more important than R&D.
Enabling environment	Exporters and importers highlight the importance of a favorable business environment for exporting perishable goods.
	They also emphasize the relevance of functional services to comply with regulations and international private sector requirements; they prefer to have a choice of suppliers instead of depending on only one.
	Lessons from best practice countries concerning the business environment of the agro-industry (Peru, Chile) highlight the consistency between national standards and international certification requirements.

**Table 1: Constraints in Thai Exotic Fruits**

## 2.4 Results Interviews

Four Dutch importers were interviewed concerning Thai agro logistics. They were asked about their experience with importing fruits from Thailand. All importers confirmed the potential of Thai fruits. Thailand offers a great variety of good quality exotic fruits. However, the importers also mentioned some bottlenecks. In relation to these bottlenecks, two types of importers could be distinguished: (smaller) importers focusing mainly on specialties and (larger) importers rather focusing on commodities. The importers focusing on specialties emphasized the problem that

Thai products frequently exceed the MRLs. The importers focusing on commodities source produce from carefully selected farms. They also mentioned the MRL problem, but also pointed out other limitations (e.g. concerning post-harvest activities and chain conditions). This group of exporters.

#### *2.4.1 Overview of Agro Logistical Bottlenecks*

In general, the next bottlenecks regarding exporting Thai products to the European market can be distinguished:

##### Poor product handling:

Thai farmers are handling fruits not efficiently. They are using inappropriate and unclean machineries, relying on prohibited chemical fertilizers and implementing improper post harvest methods. Also diseases occur on the fruits due to insufficient cultivating practice in the pre-harvest period.

##### Chemical residues:

Thai farmers are still relying on by the EU prohibited chemical fertilizer and pesticides. When laboratories of the European market find residues of these chemicals on the products, the products will be rejected.

##### Broken cold chains:

The transport of fruits from farm to packing station is unconditioned. Further in the supply chain, products might be delivered into cold storage but also might continue by unconditioned logistics. Facilities at the airport of Bangkok are good, i.e. cold stores are available, facilities are relatively new, modern and clean, et cetera. The temperate settings are not always sufficient however. For perishables a broken cold chain almost always results in a decrease of product quality and shelf life.

##### Inconsistent certification scheme:

Mostly, Thai products are not in line with required quality standards from the European market (like GlobalGAP).

##### Outdated packaging:

Mostly, the Thai still rely on old packaging concepts, which are of limited quality (i.e. ventilation, strength, weight, used materials, et cetera) and most of the time they lack sufficient information that European importers demand. Not only in relation to GlobalGAP but also customer demands and European law. This is due to the lack of finance to implement modern packaging techniques.

##### Inefficient loading at airfreight capacities and high airfreight cost:

There is inefficient loading at the airfreight. Besides that the costs for exporting fruits to the European market is quite high for Thai exporters. For mango e.g. the costs are € 2.40 (114 Baht)

per kilogram. Airfreight costs are relatively high in Thailand in comparison to their neighboring countries due to lack of cargo space and high costs of using Thai airspace.

## **2.5 Specific Problem: Maximum Residue Levels**

Pesticides are used to protect crops from damage due to for example insects, fungi, bacteria, or weeds. It is estimated that about 1100 chemicals have been developed or isolated to be used as pesticides. Not all are still used however, as some are banned or obsolete. The use of pesticides may result in residues on crop commodities. To protect the health of the consumer maximum residue limits are set. Generally, not only safety concerns play a role however in setting these levels. The MRLs are normally laid down in (inter)national legislation and therefore have to be met.

In Thailand a large number of plant protection products (16,900) containing approximately 400 active ingredients are registered for marketing and use in Thailand (EC, 2006), which is about 300 more than in many other countries. In the period 1994 – 2004 the quantity of imported agricultural pesticides trippled to more than 80 thousand tones per year (Pollution Control Department, 2004 in Tirado et al. 2008). Fruits and vegetables are the most pesticide-intensive crops in many countries, this applies to Thailand as well (Boselie and Buurma, 2003, Tirado et al. 2008.). The high pesticide use may result in residues in harvested fruits and vegetables. Statistics on EU and Netherlands' imports of fruits and vegetables from Thailand reveal a high percentage of non-compliance with EU MRL regulations in a couple of crops like yard-long bean, egg plant, mango and chilli peppers over the years (EC, 2006 and various VWA reports).

Compliance assistance is one way to improve compliance with legislation. Following “Good Agricultural Practices” farmers will be able to meet the MRLs of pesticide residues. In order to use GAP, farmers should, of course, be familiar with these practices. Knowledge on GAP can be provided by for instance information services of the National authority, of producer groups, buyer groups etc. A second possibility is the use of incentives, both negative (penalties) and positive (bonuses) for the producers to comply with specifications, more specific the MRLs. To improve compliance, a mix of different instruments can be used. There is no “best” mix of instruments available. They depend on the local circumstances.

A point of consideration is that further processing might reduce the residue level in the end product. For instance peeling the skin of a fruit will remove the residues present on the skin. On the other hand, a technology, like evaporation, that thickens the original mass, will probably increase the residue level in the end product. The aforementioned examples are, of course, a simplification of the often complex situation concerning residues and further processing.

For an elaboration on implementation of GAP by horticultural producers in Thailand and an elaboration on MRL legislation: see appendix 1 and 2.

### 3 Logistic Concepts

#### 3.1 Introduction to Logistic Concepts

The previous chapter describes the potential of Thailand's fruit production. Agro logistical bottlenecks are mentioned as well. In general, the shelf life of Thai exotic fruit products is limited. This makes airfreight the only method to export exotic fruits to the European market. But airfreight is very expensive. One possible solution is to increase the shelf life of the products. For example by means of enhancement of the cultivation process (cutting back plants, using fertilizers), improvement of the selection process (check on quality and ripeness), pre-cooling of the products and conditioning of the chain.

A second challenge is a logistical challenge: finding an alternative and cheaper concept to export fruits to the European market. Another challenge is leveraging the Thai fruit sector as a whole by making Thailand serve as a local logistical hub. This chapter elaborates on the challenges above. Different concepts were designed and one concept was tested in practice.

#### 3.2 Overview of Logistic Concepts

Several concepts for the Thai agro logistics were reviewed. The concepts focus on commodities rather than on specialties (due to the need for volume). Some concepts can be combined with each other. Three types of concepts are distinguished:

- Postharvest concepts;
- Export concepts;
- Macro economic concepts.

<b>POST HARVEST CONCEPT</b>	
1 Container on location	<p>The idea is to put a container on location: as close to the grower as possible. Harvested products can be loaded in the containers directly. The concept offers opportunities to control the beginning of the chain and to decrease value and/or quality loss. Relevant variations of this concept are:</p> <ul style="list-style-type: none"><li>▪ Container at the farm or container at the packing centre (depending on the accessibility of the farm).</li><li>▪ Stuffing container with pre cooled products or hot (the latter is called hot stuffing and is depending on the availability of electricity at the farm).</li><li>▪ Need or no need for collecting products at different farms for creating volume and mixed containers (depending on product assortment and production volume of the farm).</li><li>▪ Applying or not applying 'ready to pick' principle at the farm to improve product quality upon arrival (depending</li></ul>

	<p>on the learning abilities of the farm).</p> <ul style="list-style-type: none"> <li>▪ Apart of selection on ripeness also selection on the quality. Fruit without any damages will have a longer shelf life is the hypothesis. This concept will make reefer transport more relevant. Special boxes will protect the fruit from bruising.</li> <li>▪ Using or not using ‘specific packaging’ at the farm to decrease value and/or quality loss (depending on the learning abilities of the farm).</li> </ul>
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<b>EXPORT CONCEPTS</b>	
2 Sea-air bridge	The idea is to combine sea transport with air freight. Namely: sailing the goods to United Arab Emirates or Singapore, re packing the goods and then flying the goods to The Netherlands. The concept offers opportunities to decrease the transportation costs (compared to flying only) and to decrease the duration of transport (compared to sailing only). With this concept it is also possible to make use of less busy routes that have enough capacity. The fact that the transport is indirect is a disadvantage, i.e. products are undergoing a modal shift from boat to plain and the cold chain therefore has to be broken.
3 Air-sea bridge	The idea is to combine air freight with sea transport. Namely: flying the goods to Singapore, re-packing the goods and then sailing the goods to The Netherlands. The concept offers opportunities to decrease the transportation costs (compared to flying only) and to decrease the duration of transport (compared to sailing only). With this concept it is also possible to make use of least busy routes that have enough capacity. The fact that the transport is indirect is a disadvantage, i.e. products are undergoing a modal shift from plain to boat and the cold chain therefore has to be broken.
4 Air triangle	The idea is to charter a plane and to transport goods from Thailand to The Netherlands and to return via for example to the United Arab Emirates (assuming that there is a demand for exporting goods from The Netherlands to for example to the United Arab Emirates). The concept offers opportunities to transport the products directly and quickly to The Netherlands.

MACRO ECONOMIC CONCEPT	
5 Local hub	<p>The idea is that Thailand serves as a hub (central collection and distribution point) for the regional and world market of exotic fruits and vegetables. The concept offers opportunities for taking lead and adding value.</p> <p>The general idea of this concept is that Thailand, a producer of considerable amount of exotic fruits, vegetables and flowers both in volume as varieties, could develop towards a regional market place or hub where products not only from Thailand but also from regional producers are brought to the this hub where (potential) buyers are also present. The hub potentially supports the development of more efficiency along the value chains of the various produce at offer as well as an improved functioning of the markets.</p> <p>In addition, bringing both suppliers and buyers physically together at one place potentially has a positive impact on the overall product quality over time. (In analogy to the positive influence that the Dutch flower auctions had and are still having on the level of the overall product quality of the flowers.)</p>

Table 2: Future agro logistic concepts

The table below shows the prerequisites for the variations mentioned for the concept ‘container on location’.

	Accessibility of farm	Availability of electricity on farm	Large production volume	Wide assortment	Learning abilities of farmer	
<b>Container on location</b>						
> Container nearby field	!				!	Alternative = container nearby packing centre
> Hot stuffing		!				Alternative = pre cooled container
> No collection needed (volume)			!			Alternative = collection round needed
> No collection needed (assortment)			!	!		Alternative = collection round needed
> Applying ready to pick					!	Alternative = no ready to pick
> Using specific packaging					!	Alternative = no specific packaging

Table 3: Table: Prerequisites ‘container on location’

### **3.3 Logistic Concepts Tested in Practice**

Different importers and logistical companies were interviewed. They were asked what they consider to be agro logistical opportunities for Thailand and they were asked to give a reaction on the concepts described above. All parties confirmed the importance of the postharvest concept (cautious postharvest processes). Not all, but most of the interviewed parties considered the sea-air-bridge to be the logistic concept with the highest potential. This concept combines sea transport with air freight. It offers opportunities to decrease the costs of transportation.

## 4 Conclusions

### 4.1 Final Outcomes

This report shows that despite its potential, Thailand is not doing very well yet in entering overseas markets. Partially this is because of exceeding maximum residue levels, but also because of other agro logistical limitations like suboptimal post harvest processes and conditioning of the chain. These limitations result in a limited shelf life of the products. This makes airfreight the only option to export products to Europe. Airfreight is expensive, though. Thailand faces the challenge of increasing the product shelf life on the one hand and finding alternative and lower costing logistical concepts on the other hand.

Implementing new concepts results in new challenges. For example: exporting cut fruits is a feasible solution to rigid maximum residue levels. But cut fruits are more fragile than non processed fruits. Cut fruits require another logistical solution (e.g. packaging and conditioning) than non processed fruits.

### 4.2 Further Research

#### 4.2.1 Pilots

Pilots offer a great opportunity to obtain practical insight in the implementation of new concepts. Besides, pilots require and benefit from the participation of both Dutch and Thai parties. Ideally pilots result in a blue print from which the Thai fruit sector as a whole can benefit.

#### 4.2.2 Logistic concepts

During the several interviews with stakeholders the market-economic concept that focuses on Thailand as a hub for the exotic fruit and vegetable world market kept coming up during these talks<sup>1</sup>.

The potential advantage of such a concept for the overall performance and growth of the Thai fruit and vegetable sector as a whole, let alone other positive side effects, is obvious and does not need further explanation. However, if market players from other regions and the world market will accept Thailand in such a function is a different issue altogether for which, perhaps, the ASEAN could be an appropriate platform to decide upon.

The general idea behind the concept of a regional hub, where (international) buyers and suppliers meet is that it supports the further development of comparative and competitive advantages at national and supply chain levels respectively. This will, with appropriate sets of policies, regulations and instruments in place, ultimately result in a more efficient and sustainable resource use and a better functioning of the local, regional and world market of (exotic) fruits and

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<sup>1</sup> Next to Thailand, other locations in the South-East Asian region could be considered as a hub for the regional and world market, notably Singapore. If this concept is to be researched further it is suggested that 1-2 other locations are selected for the purpose of comparison while appropriate criteria are developed.

vegetables at large. Roughly speaking, the effects of well-functioning hubs will be that producers will receive relative higher prices for their produce and that consumers will pay relatively lower prices for the products. Both outcomes entail economic growth through multiplier effects.

In addition, bringing both suppliers and buyers physically together at one place potentially has a positive impact on the overall product quality over time. (In analogy to the positive influence that the Dutch flower auctions had and are still having on the level of the overall product quality of the flowers.)

Issues that will have to be researched further are: is Thailand the best location to become a local hub? What does the hub function imply at the level of the development and coordination of (regional) policies, regulations and instruments? How should the hub be organized, etcetera.

#### *4.2.3 Involving Thai Parties*

Insight in the strengths and weaknesses of the agro logistics in Thailand are in this project gained through extensive desk research, expert knowledge, experience acquired during other projects (i.e. “Integrated Supply Chain Management of Exotic Fruits from the ASEAN region”, Asian-Invest Programme) and stakeholders interviews. But most of the knowledge, insight and experience is directly related to experts, organizations, et cetera in The Netherlands.

Unfortunately in this project we did not manage to arrange a participatory workshop as planned. Although some interviews with Thai stakeholders were held, bringing together the needed stakeholders requires a good network and exhaustive planning which was not feasible within the timeframe of this project.

However, the involvement of Thai partners to discuss agro logistical challenges and to exchange knowledge is an important aspect in a process of innovation and the development of sustainable markets and chains. A participatory workshop whereby all relevant stakeholders would be partaking in (1) value chain analyses of selected products and/or commodities to identify options for improved chain performance, and (2) devise supportive policies, programs and instruments, could prove to be an excellent method to support this process. It is recommended that such a workshop should be one of the first activities to be undertaken in the process of fact-finding (from a Thai point of view) and optimizing parts of the Thai agro logistics.

Therefore, it is important to involve the Thai stakeholders. For the cut pomelo pilot knowledge of Kasetsart University in Thailand has been included. The agro logistical concepts have not been discussed with Thai partners however. It is desirable that a workshop in Thailand will be organized to discuss concepts and results and to transfer knowledge.

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- Kuene & Nagel, Schiphol
- KLM Cargo, Schiphol
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- Dept. of Logistics Strategy Division, Off. of the Prime Minister

## **Appendix 1: Implementation of GAP by horticultural producers in Thailand**

### **Introduction**

In Thailand a large number of plant protection products (16,900) containing approximately 400 active ingredients are registered for marketing and use in Thailand (EC, 2006), which is about 300 more than in many other countries. In the period 1994 – 2004 the quantity of imported agricultural pesticides trippled to more than 80 thousand tones per year (Pollution Control Department, 2004 in Tirado et al. 2008). Fruits and vegetables are the most pesticide-intensive crops in many countries, this applies to Thailand as well (Boselie and Buurma, 2003, Tirado et al. 2008.). The high pesticide use may result in residues in harvested fruits and vegetables. Statistics on EU and Netherlands' imports of fruits and vegetables from Thailand reveal a high percentage of non-compliance with EU MRL regulations in a couple of crops like yard-long bean, egg plant, mango and chilli peppers over the years (EC, 2006 and various VWA reports).

The Thai Government has tried to solve the problems around MRLs in various ways (EC, 2006), among these are:

- Legal instruments being Notifications under the Food Act, 1979 and the Export and Import of Good Act, 1979;
- Notification by the Department of Foreign Trade, 2003, implemented by the Department of Agriculture (DOA), which requires that all batches of 12 specific commodities must be tested for the presence of 53 pesticides and certified before being exported. These 12 commodities of economic importance are: longan, durian, lychee, mangosteen, sweet tamarind, mango, pummelo, asparagus, ginger, okra, baby corn and chilli. The exporters are required to have a Certificate of Pesticide Residues from DOA, containing a list of 30 active ingredients (only insecticides) and not 53 for various reasons according to DOA;
- Establishment of a food safety strategy, which has been implemented by the DOA since 2004. The strategy includes a voluntary national system which involves certification of farms for Good Agricultural Practice (GAP).

Implementation of GAP has been recommended by different experts (e.g.: Buurma et al. 2003, Liu, P., 2007, and Wannamolee, W., 2008) and it is generally considered to be one of the important tools, but not the only one(!), to solve the problems related to quality and food safety requirements of both export and domestic markets.

### **Good Agricultural Practice**

As indicated in the above, DOA has set up the national quality management system, called ThaiGAP, for agricultural production. It was developed by modifying concepts of international standards like GLOBALGAP. ThaiGAP has three levels of certification (Liu, 2007 and Wannamolee, 2008):

- Step 1. pesticide residue safe
- Step 2. pesticide residue safe and pest free

- Step 3. pesticide residue safe and pest free with premium quality

The ThaiGAP standard contains eight control points:

- (i) water source and its safety
- (ii) cultivation site
- (iii) use of agricultural hazardous agrochemicals
- (iv) product storage and on-site transportation
- (v) data records
- (vi) production of pest (and disease) free products
- (vii) management of product quality
- (viii) harvesting and post harvest handling

For step 1 control point (i) – (v) are required, for step 2: (i) – (vi) and for step 3: (i) – (viii). The certification is exempted from any fees, while DOA is both auditor and certifier of the farms. The farmers have to get advice from a GAP advisor of DOA itself or of the Department of Agriculture Extension (DOAE) who must make a production plan in order to comply with GAP guidelines. Certification is granted when the farm has been inspected and proven to comply to the ThaiGAP requirements.

Wannamolee (2008) reported that in May 2008, DOA registered 363,946 farm for GAP, of which 169,886 farms were certified for GAP with a total area of 190,621 hectares (excluding rice farms). The majority of the certification for fruit crops were for longan (59,247 farms, total 58,178 ha), durian (11,073 farms, total 18,487 ha), mangosteen (14,295 farms, total 18,306 ha), and mango (7,469 farms, total 16,465 ha), while for vegetables baby corn (1,382 farms, total 736 ha) and asparagus (1,608 farms, total 533 ha) were certified.

As the ThaiGAP system is not internationally benchmarked, the Thai Fruit and Vegetables Producers Association tries to obtain benchmarking with GLOBALGAP. Presently an independent witness assessment is being carried out ([http://www.globalgap.org/cms/front\\_content.php?idcat=9](http://www.globalgap.org/cms/front_content.php?idcat=9), 2009). GLOBALGAP certification is more interesting for export to countries of the EU. Only a few large-scale producers are GLOBALGAP certified (Hoffmann, 2007 and Wannamolee, 2008), while for the other large scale farms GLOBALGAP certification is becoming essential (Johnson et al., 2008).

On ThaiGAP Hoffmann (2007) observed the following:

- The Government developed and runs the scheme (there is no third party certification), DOA certifies farmers.
- The scheme almost exclusively target the national market and national food quality and safety.
- ThaiGAP is recognized on a bilateral basis by a few major trading partners (China and Japan).
- ThaiGAP largely focus on pesticides use (level 1), with little attention to environmental issues, worker welfare, and microbial contamination.

- ThaiGAP certified products are awarded a label (Q-mark). The label, however, does not entitle to or guarantee a price premium.
- The Government of Thailand bears a considerable part of running costs of the scheme, including inspection, testing, certification and training costs.
- A multi-tier approach, ThaiGAP scheme is supplemented by a premium GAP scheme in one region (Western GAP region) that focuses on export market.

### **Implementation of GAP**

It is clear that ThaiGAP and the above mentioned Notification by the Department of Foreign Trade (in 2003 and implemented by DOA) are not yet fully effective to control problems around MRLs as proven by the frequent MRL non-compliance of horticultural products imported in EU countries from Thailand.

Apart from institutional and value chain issues as indicated above, Wannamolee (2008) lists a number of challenges that have to be tackled at producers' level, which should be solved by providing GAP training and advisory services for both individual growers and grower groups. So far DOA or DOAE are involved in GAP advisory services. Obviously these do not have the wished effect., which may be due to a couple of factors, such as (i) the complex nature of the GAP topics for advise to the farmers, (ii) the used methods and quality of advisory services, (iii) the strong influence on farmers by pesticide retailers, and linked to this issue, the quality of the advice by pesticide retailers (obviously pesticide linked advice), and (iv) too many different pesticides are on the market in Thailand that are not allowed in the EU.

Experiences in the application of integrated pest management (IPM) should assist Thai farmers to diminish the use of pesticides and thus reduce pesticide residue risks and meet ThaiGAP and GLOBALGAP requirements. GAP technologies, like IPM, are complex and often location specific. In many countries it has been proven that extension on complex issues, like IPM and GAP, cannot be done in a linear top-down transfer of technologies approach, but rather needs a group approach based on adult learning. An example of such an approach is the Farmer Field School (FFS). This approach proved effective in reducing pesticide use in different crops, including vegetables in a couple of countries in South East Asia (van den Berg, 2004) and e.g. in rice growing in Thailand (Praneetvatakul and Waibel, 2006). Annex 1. provides a short overview of the FFS approach. The FFS groups can be developed into producer groups (see below). Producer groups can be GLOBALGAP certified as a group under certain conditions. Thus in a producer group the farms do not need to be certified individually, which is a considerable cost reduction.

Implementation of FFSs by extension staff requires additional skills on top of the technical knowledge and communication skills they have. Particularly, the process approach in FFSs groups requires specific facilitation skills. In many countries so called season-long trainings are organised for this purpose. In these trainings extension staff gains knowledge and skills on

facilitation of farmers' groups and on technologies of the crops of the FFS groups. Often short-cuts are used for the season-long trainings resulting mostly in decreased quality of FFSs implementation.

Large scale and advanced farmers can benefit from a transfer of technology approach provided that high quality training is given and supporting training materials are provided. The economic benefits of GAP implementation, without an increased product price, should be understood by the farmers. Depending on the situation something like small study clubs of farmers with the same crop can be a good extension tool as well. This may be combined with the organization of producer groups.

### **Benefits of Group Certification**

Producer groups can apply for group certification. This certification has shown to a proper alternative to support GAP certification of small-scale and medium-scale farms, provided that:

- good group cohesion and management structures are in place to enhance transparency and trust in the group;
- group cohesion is maintained in order to ensure sustainability and get farms re-certified every year;
- good contractual relationships with buyers (exporters) are maintained in order to have market access; and
- financial mechanisms are available to maintain the quality management system to allow the group to respond to problems that lead to financial risks.

The formation of producer groups has to be guided and supported by extension services. Like for the implementation of FFSs, the support to develop producer groups requires specific expertise.

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## Appendix 2: MRL Regulations

### World

According to the (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPM) and Agreement on Technical Barriers to Trade, food safety standards for pesticide residues established by the Codex Alimentarius Commission are the reference points in international trade. Thus far, Codex established MRLs for about 225 pesticides (and for numerous pesticide/commodity combinations). (Databank Codex alimentarius: Pesticide Residues in Food, Maximum Residue Limits; Extraneous Maximum Residue Limits.

[http://www.codexalimentarius.net/mrls/pestdes/jsp/pest\\_q-e.jsp](http://www.codexalimentarius.net/mrls/pestdes/jsp/pest_q-e.jsp))

Once accepted member states of Codex are expected to implement these MRLs in national (or community) law. According to the website of the codex commission Thailand is a member of Codex alimentarius and therefore is obligated to incorporate these MRLs into national law. Deviations from Codex MRLs are possible but have to be substantiated with scientific proof of risk.

### MRL's for residues of Pesticides and the EU

From European Commission, Directorate Health and Consumers.

It is necessary to ensure that pesticide residues should not be found in food or feed at levels presenting an unacceptable risk to humans. Maximum residue levels (MRLs) are therefore set by the European Commission to protect consumers from exposure to unacceptable levels of pesticides residues in food and feed.

In the EU, as from 1 September 2008, a new legislative framework ([Regulation \(EC\) No 396/2005](#) of the European Parliament and of the Council) on pesticide residues is applicable. This Regulation completes the harmonisation and simplification of pesticide MRLs, whilst ensuring better consumer protection throughout the EU. With the new rules, **MRLs** undergo a common EU assessment to make sure that all classes of consumers, including the vulnerable ones, like babies and children, are sufficiently protected. Moreover, the new harmonised Community provisions also facilitate commerce, by eliminating inappropriate technical barriers to trade.

All decision-making in this area has to be science-based and a consumer intake assessment has to be carried out by the European Food Safety Authority before concluding on the safety of an MRL.

## Legislation in the EU

Until 1 September 2008, the legislation for pesticide residues was a shared responsibility of the Commission and the Member States. Since 1976, more than 45.000 Community MRLs have been set for various commodities for 245 pesticides on cereals ([Directive 86/362/EEC](#)), foodstuff of animal origin ([Directive 86/363/EEC](#)), fruit and vegetables and other plant products ([Directive 76/895/EEC](#) and [Directive 90/642/EEC](#)). For the tens of thousands of pesticide/commodity combinations for which no Community MRLs existed, Member States could set MRLs at national level to facilitate trade and to protect the health of their consumers.

However, safety of consumers in one country does not necessarily mean that all consumers in the EU are protected, because food consumption patterns differ from one Member State to another. Nowadays food and feed circulate freely on the EU internal market, and therefore it is indispensable to assure that all EU consumers are equally protected from the exposure to unacceptable levels of pesticides in their food.

As from 1 September 2008, [Regulation \(EC\) No 396/2005](#) of the European Parliament and of the Council on maximum residue levels (MRLs) of pesticides in products of plant and animal origin defines a new fully harmonised set of rules for pesticide residues. This Regulation simplifies the existing legislation by harmonising pesticide MRLs and making them directly applicable.

The [Annexes](#) to Reg. (EC) No 396/2005 specify the MRLs and the products to which they apply. **Annex I** is the list of products to which the MRLs apply. Annex I has been established by Commission [Regulation \(EC\) No 178/2006](#). It contains 315 products, including fruits, vegetables, spices, cereals, animal products.

**Annex II** is the list of EU definitive MRLs and it consolidates the existing EU legislation before 1 September 2008. It specifies MRLs for 245 pesticides.

**Annex III** is the list of the so-called EU temporary MRLs. It is the result of the harmonisation process as it lists pesticides for which, before 1 September 2008, MRLs were only set at national level. It specifies MRLs for 471 pesticides.

**Annex IV** is the list of pesticides (52) for which no MRLs are needed because of their low risk.

**Annex V** will contain the list of pesticides for which a default limit other than 0,01 mg/kg will apply. This Annex has not been published yet.

**Annex VI** will contain the list of conversion factors of MRLs for processed commodities. This Annex has not been published yet.

**Annex VII** contains a list of pesticides used as fumigants for which the Member States are allowed to apply special derogations before the products are placed on the market.

If a pesticide is not included in any of the above mentioned Annexes the **default MRL** of 0,01 mg/kg applies (Art 18(1b) of Reg. (EC) No 396/2005).

[Implementation of Reg. \(EC\) No 396/2005](#)

## Database

The EU pesticide residues database provides for a search tool for all the EU-MRLs set in Reg. (EC) No 396/2005.

The database is freely and easily accessible by every citizen. It reflects the most up-dated published legislation under Reg. (EC) No 396/2005.

Please click on the logo below to enter in the database:



Or follow next link([http://ec.europa.eu/sanco\\_pesticides/public/index.cfm](http://ec.europa.eu/sanco_pesticides/public/index.cfm))

### **Enforcement**

Farmers, traders and importers are responsible for food safety, which includes compliance with MRLs. Member State authorities are responsible for control and enforcement of the MRLs. These checks will entail taking samples, analysing them and identifying the pesticides and respective pesticide levels present therein. To ensure that this is done in an adequate and uniform way, the Commission has three instruments:

(1) The co-ordinated [EU multi-annual control programme](#) sets out for each Member State the main pesticide-crop combinations to monitor and the minimum numbers of samples to take.

Member States have to report the results, which are published in an [annual report](#).

(2) [Community Reference Laboratories](#) co-ordinate, train staff, develop methods of analysis and organise tests to evaluate the skills of the different national control laboratories.

(3) [The Food and Veterinary Office](#) of the Commission carries out inspections in the Member States to assess and audit their control activities.

If pesticide residues are found at a level of concern for consumers, the [Rapid Alert System for Food and Feed](#)(RASFF) circulates the information and measures are taken to protect the consumer.

### **Regulation (EC) No 396/2005 and amendments**

[Regulation \(EC\) No 299/2008 of the European Parliament and of the Council](#) of 11 March 2008 amending Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin, as regards the implementing powers conferred on the Commission

[Regulation \(EC\) No 396/2005 of the European Parliament and of the Council](#) of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC.

### **[Consolidated version](#)**

Annexes I, II, III, IV and VII

## Annex I

[Commission Regulation \(EC\) No 178/2006](#) of 1 February 2006 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council to establish Annex I listing the food and feed products to which maximum levels for pesticide residues apply.

## Annexes II, III and IV

[Commission Regulation \(EC\) No 1097/2009 of 16 November 2009](#) amending Annex II to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for dimethoate, ethephon, fenamiphos, fenarimol, methamidophos, methomyl, omethoate, oxydemeton-methyl, procymidone, thiodicarb and vinclozolin in or on certain products.

[Commission Regulation \(EC\) No 1050/2009 of 28 October 2009](#) amending Annexes II and III to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for azoxystrobin, acetamiprid, clomazone, cyflufenamid, emamectin benzoate, famoxadone, fenbutatin oxide, flufenoxuron, fluopicolide, indoxacarb, ioxynil, mepanipyrim, prothioconazole, pyridalyl, thiacloprid and trifloxystrobin in or on certain products.

[Commission Regulation \(EC\) No 822/2009 of 27 August 2009](#) amending Annexes II, III and IV to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for azoxystrobin, atrazine, chlormequat, cyprodinil, dithiocarbamates, fludioxonil, fluroxypyr, indoxacarb, mandipropamid, potassium tri-iodide, spirotetramat, tetraconazole, and thiram in or on certain products.

[Commission Regulation \(EC\) No 256/2009 of 23 March 2009](#) amending Annexes II and III to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for azoxystrobin and fludioxonil in or on certain products.

[Commission Regulation \(EC\) No 839/2008](#) of 30 August 2008 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards Annexes II, III and IV on maximum residue levels of pesticides in or on certain products.

[Commission Regulation \(EC\) No 149/2008](#) of 29 January 2008 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council by establishing Annexes II, III and IV setting maximum residue levels for products covered by Annex I thereto.

[Corrigendum to Commission Regulation \(EC\) No 149/2008](#)

## Annex VII

[Commission Regulation \(EC\) No 260/2008](#) of 18 March 2008 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council by establishing Annex VII listing active substance/product combinations covered by a derogation as regards post harvest treatments with a fumigant

[EU multi-annual control programmes](#)

[Old legislative framework](#)

Pesticide residues for Pome fruits according to Codex

[http://www.codexalimentarius.net/mrls/servlet/PesticideServlet?Pesticides=0&Items=25&outline=by+substance&Domain=PesticideMRLs&Language=english&query\\_form=%2Fmrls%2Fpestdes%2Fpest\\_q-e.htm](http://www.codexalimentarius.net/mrls/servlet/PesticideServlet?Pesticides=0&Items=25&outline=by+substance&Domain=PesticideMRLs&Language=english&query_form=%2Fmrls%2Fpestdes%2Fpest_q-e.htm)

According tot MRL databank EU:

Two different categories can be found that are possibly applicable tot pomelo's: Grapefruit (Shaddocks, pomelos, sweeties, tangelo, ugli and other hybrids) and pome fruit. A direct link to MRL's of pesticides of these categories is not possible. The general link to the selection of commodities is:

[http://ec.europa.eu/sanco\\_pesticides/public/index.cfm?event=commodity.selection](http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=commodity.selection)