Greenhouse horticulture in Malaysia

Policy Brief

Introduction

A greenhouse suitable for lowland tropics has been developed during 2008 - 2012 in a collaborative project between The Department of Agriculture of Malaysia, Wageningen University and Research Centre, and Asian Perlite Industries. The project was supported by the Netherlands Ministry of Economic Affairs, Agriculture and Innovation, and by the Malaysian Department of Agriculture.

This policy brief has been prepared under the responsibility of the Wageningen UR project team.

Summary of Recommendations

Greenhouse business case

1. **Focus on the net profit** of the tropical greenhouse. Costs are relatively high but benefits are even higher.
2. Therefore, do **not compromise on the construction**. A short life-span will in the long run be more expensive.

Training

3. Begin the training process with establishing and training a **core team of trainers** that will act as trainers in the train-the-trainer programme.
4. It is vital that the core team is **properly embedded in an organization**, e.g. NATC, to ensure sustainability of trainings.
5. Ensure that training addresses both **technical and training skills**.
6. Further test and develop the **training manual**.
7. Assign **one greenhouse to training purposes**.

Crop protection

8. Maintain the highest possible **hygiene** standards.
9. Realize **biological control** as part of integrated pest management.
10. Maintain a list of **permitted chemicals**.

Crop management

11. Use a **computerized fertigation system**.
12. **Capable farmers** are crucial.

Up-scaling

13. Other **crops**: for instance, chillies, tomatoes, and high-value vegetables.
14. Other **regions**.
15. Other **technology levels**. For each technology level, the interventions are different.

Enabling environment

16. Long-term **commitment by all stakeholders** is essential.
17. Ensure **collaboration between governmental organizations**, e.g., DoA and NATC.
18. Develop different **up-scaling approaches** based on the segmentation of farmers: small-scale, medium-scale, large scale (training, access to finance, access to inputs, etc.).

Figure 1. A view of the tropical greenhouse at the premises of the Department of Agriculture in Serdang.

Wageningen UR Greenhouse Horticulture
PO Box 644, 6700 AP Wageningen,
The Netherlands
T: + 31 317 48 60 01
F:: +31 317 41 80 94
glastuinbouw@wur.nl
www.glastuinbouw.wur.nl

Wageningen UR Centre for Development Innovation
PO Box 88, 6700 AB Wageningen,
The Netherlands
T: + 31 317 48 14 04
F: +31 317 41 68 01
info.cdi@wur.nl
www.cdi.wur.nl

Department of Agriculture
17th Floor, Precint 4, Wisma Tani,
62624, Putrajaya , Malaysia
T: + 60 388 70 30 00
F: +60 388 88 83 19
pro@doa.gov.my
www.doa.gov.my

Asian Perlite Industries Sdn. Bhd.
72B Persiaran Camellia 4, 39000
Tanah Rata,, Pahang, Malaysia
T: + 60 135 30 55 66
F: +60 549 155 88
growsys@tm.net.my

2012

The project was supported by

Ministry of Economic Affairs, Agriculture and Innovation

WAGENINGEN UR
For quality of life

Greenhouse horticulture in Malaysia

Policy Brief

Background

Protected greenhouse horticulture is a growing activity that was prioritized by the Malaysian government as an area of cooperation with The Netherlands. This type of activity in Malaysia is concentrated in the highlands of the Cameron Highlands, where land is scarce and production competes with tropical rainforest. A demonstration greenhouse was realized at Serdang in Malaysia, in the tropical lowlands where more space is available for greenhouse horticulture, under the responsibility of the Department of Agriculture (DoA). The project is a relevant instrument to help the transition of traditional horticulture in Malaysia to modern agribusiness.

The objectives of the project were to (1) demonstrate that protected horticulture is possible in the lowlands of Malaysia, (2) develop a nucleus of horticultural developments, (3) demonstrate good horticultural practices, and (4) spread these over (the lowlands of) Malaysia.

The target groups were (1) the staff of the Department of Agriculture at Serdang (2) small growers that produce for the local market and (3) large growers that produce for the national and export markets.

Issues in greenhouse horticulture in the lowland tropics

Temperature is everything in greenhouses in the tropics. High temperatures lead to fruit abortion, hanging leaves because of insufficient transpiration, and sometimes even to dying plants. In addition, pest and disease pressures in the tropic are very high. Financial possibilities are limited for small growers, whose knowledge level must be up-graded. Therefore, a greenhouse must be relatively cheap, keep the temperatures down and insects out, and be introduced with adequate training to the growers.

The current situation

The traditional greenhouses that are currently used in the Malaysian lowlands may be cheap, but are very hot inside because of the poor ventilation (there is no opening in the top of the greenhouse). Water and nutrients are not applied in the proper quantities and at the right moments, insects can enter freely, pest and disease control as a whole can be much improved, and the knowledge level of the farmers is relatively low. All this leads to low production levels.

Figure 2. Greenhouses in the Cameroon Highlands of Malaysia, where space is scarce.

Figure 3. An inside view of the tropical greenhouse at DoA.

WAGENINGEN UR
For quality of life

Greenhouse horticulture in Malaysia

Policy Brief

A greenhouse for the lowland tropics

The project developed a greenhouse especially suited for the lowland tropics, with a high natural ventilation rate. Mechanical cooling was not an option because of the high energy costs. The greenhouse has a three-span cover and tilted side walls with insect nets to reduce air resistance and top vents allowing hot air to leave the greenhouse, especially in no-wind conditions that occur frequently around noon. The top vents have a 'chimney' construction that allows the passing of wind, which stimulates the air flow from the inside of the greenhouse. The covering of the greenhouse should reduce direct solar radiation by making the light penetrating the greenhouse diffuse, which reduces high temperatures in the top of the canopy.

The greenhouse has insect nets at all openings and a double-door sluice to prevent insects from entering. The ground is covered with white plastic to prevent the growth of weeds and soil-born diseases, and plants are grown in white poly-bags filled with locally available cocopeat. The greenhouse is equipped with a computer installation that can manage the application of water and nutrients ('fertigation') on the basis of the climate and the needs of the crop.

All construction materials can be obtained locally, which reduces costs. Only the computer has to be imported.

It is tempting to reduce costs by using cheaper materials, to reduce the height of the greenhouse and therewith to reduce the amount of materials needed, or not to install a computer system. However, this will lead to a shorter life span, an adverse climate, and low yields. The consequence is that no profit is made. Reduced investments result in even greater losses of profit.

A financial comparison between a traditional greenhouse, a tropical greenhouse with a simple computer and a tropical greenhouse with an advanced computer learns that investments for the latter type are highest, but that the pay-back time is shortest. The extra investment results in an even greater production. Interestingly, a traditional greenhouse is not profitable at all if all costs with interest are accounted for.

Recommendation 1. Focus an investment policy on the net profit of the tropical greenhouse. Costs of an advanced tropical greenhouse are relatively high but benefits are even higher.

Recommendation 2. Do not compromise on the construction to reduce the investment costs. A short life-span will in the long run be more expensive.

Issue	Dimension	Tropical greenhouse, advanced computer	Tropical greenhouse, simple computer	Traditional greenhouse, no computer
Investment costs	Rm m^{-2}, only year 1	124.7	119.7	59.7
Operational costs	Rm m^{-2} $year^{-1}$	31.2	31.2	31.4
Maintenance costs	Rm m^{-2} $year^{-1}$	4.8	3.7	3.8
Returns (per year)	Rm m^{-2} $year^{-1}$	83.8	71.2	41.1
Pay-back time, 0% interest	years	2.5	3.3	9.9
Pay-back time, 11% interest	years	4.0	6.2	No profit

WAGENINGEN UR
For quality of life

Greenhouse horticulture in Malaysia

Policy Brief

Training

Greenhouse horticulture is a knowledge-intensive activity. On top of that, presence of the farmer is required on a daily basis to check the computer and fertigations systems, and perform checks on the crop. DoA staff has gained experience with the tropical greenhouse during four seasons, during which important steps made. On the whole, however, the knowledge level in Malaysia is not in line with latest insights with regards to crop management, fertigation and climate control. DoA staff and local growers should be further equipped with knowledge, which will enable them to make the most out of the demonstration greenhouse.

The greenhouse concept and required knowledge must now be spread further over the country. Small and large commercial growers, being distinct sectors, have different needs and commercial perspectives, and require different approaches.

The training manual for greenhouse horticulture in Malaysia that was developed within the framework of the project provides an approach to enhance both training skills and technical skills. The curriculum covers a full growing season with periodic training provided. It is recommend that a training programme for Malaysia begins with the training of a core team of, for instance, 20 persons that will act later on as teachers in a training of trainers (ToT) programme. In ideal situation, these people would represent the training centres of NATC that focus on horticulture, thereby ensuring proper embedding and sustainability of training activities. Subsequently, these 20 persons can train their colleagues in small groups of, for instance, 5 persons. This larger group can eventually train farmer-students.

The training manual we produced is a first version. We would welcome testing an further development of the manual.

If the training programme in a greenhouse coincides with the production process, it is unavoidable that it will have negative impact on the production process due to increased risks in terms of hygiene, crop growth, fertigation regime, etc., and that the yield will be lower. Therefore, training should be given in a greenhouse especially assigned for this purpose. Certain compensation to the grower normally using this greenhouse for the decrease yield is strongly recommended.

Recommendation 3. Begin the training process with establishing and training a core team of trainers that will act as trainers in the train-the-trainer programme.

Recommendation 4. It is vital that the core team is properly embedded in an organization, e.g. NATC, to ensure sustainability of trainings.

Recommendation 5. Ensure that training addresses both technical and training skills.

Recommendation 6. Further test and develop the training manual.

Recommendation 7. Assign one greenhouse to training purposes.

Figure 4. A group of trainees visiting the tropical greenhouse at DoA. For sanitary reasons, entrance was not permitted.

WAGENINGEN UR
For quality of life

Greenhouse horticulture in Malaysia

Policy Brief

Crop Protection

The levels of pests and diseases are very high in the tropics. The greenhouse construction itself is an important measure to keep insects away from the crop. But this only works if nets are placed in all openings, holes in the greenhouse cover are immediately repaired, a double-door sluice is used, only the grower has access to the greenhouse, and other stringent hygiene measures are implemented at all times – no exceptions permitted.

Integrated Pest Management uses chemicals as one of the last resorts. Not all chemicals can be used, because they are harmful to beneficials (see below) or to human beings, or contaminate the surface water. Develop a list of permitted chemicals, update this list periodically, and have it available at the greenhouse. Scouting and monitoring for insect and taking the appropriated action is a crucial part of IPM. Training is needed.

Recommendation 8. Maintain the highest possible hygiene standards.

Recommendation 9. Realize biological control as part of integrated pest management.

Recommendation 10. Maintain a list of permitted chemicals.

Figure 5. A leaf infected with melon yellow spot virus. Infected plants must be removed.

Crop Management

A computer system is needed to provide the crop with the right amounts of water and nutrients at the right moments (based on measurement of greenhouse temperature, relative humidity, solar radiation or moisture content of the substrate). It is very difficult, if not impossible, to do this manually. This is certainly worth the investment. Traditional greenhouses in Malaysia are manually operated, or have a time-clock at best. As result, plants suffer from severe water stress, especially at noon.

The greenhouse farm must be managed and operated by capable and committed farmers. Commitment, experience, entrepreneurship, willingness to be present over the weekends and any other moment the greenhouse or crop has to be taken care of, openness to experiment on a small scale with new crop management techniques, a learning attitude, are some of the desired characteristics of a competent farmer.

Recommendation 11. Use a computerized fertigation system.

Recommendation 12. Capable farmers are crucial.

Figure 6. Application of sensor and computer technology to realize optimum application of water and nutrients.

WAGENINGEN UR
For quality of life

Greenhouse horticulture in Malaysia

Policy Brief

Up-scaling

Until now, DoA has cultivated rock melon for four seasons at the Serdang greenhouses. From a policy perspective it is good to distinguish a number of ways in which greenhouse horticulture can be up-scaled.

Firstly, it is recommended that the cultivation of new crops is tested and improved. For instance, chillies, tomatoes and high-valuable vegetables can be considered. The economics of the greenhouse for these crops may differ from that of the rock melon.

Secondly, the greenhouses can be constructed in other regions. As long as the climate is similar to the one in Serdang, the same greenhouse design can be used. In hill regions, where it is cooler and the ventilation requirements are lower, the greenhouse could be made one span wider.

Thirdly, other levels of technology could be developed and implemented. As greenhouse horticulture advances, at some point a new level of technology can become necessary. It is good to keep this in mind, especially if large-scale commercial farmers become interested. The appropriate interventions differ among technology levels. For instance, large-scale commercial farming may require an international supply chain and a careful check on residue levels.

Enabling environment

Greenhouse farming requires the full commitment of all stakeholders. Governmental institutions, farmers, researchers, extension officers, traders in the supply chain, financing bodies, etcetera. All stakeholders have their own role, in which they should not fail as otherwise the fragile system of cooperation collapses. Just to mention a few examples: if training is not supplied, then new farmers will not be in the position to economically run their farm. And if the market is not transparent, then price setting may be disadvantageous for the farmer. The grower should be allowed to use the land on which the greenhouse is to be constructed at least for 4-6 years (payback time) if he is willing to invest.

One important example is the benefit that good cooperation among governmental bodies will offer. DoA has the greenhouse facilities and possesses currently the knowledge, whereas NATC is suited to train farmers. Good cooperation between these two bodies will be to the benefit of all.

Figure 7. Harvest of a crop melon crop. Yields in a tropical greenhouse are double the yield in a traditional greenhouse.

Recommendation 13. Enable and implement up-scaling to other crops: for instance, chillies, tomatoes, and high-value vegetables.

Recommendation 14. Enable and implement up-scaling to other regions.

Recommendation 15. Enable and implement up-scaling to other technology levels. For each technology level, the interventions are different.

Recommendation 16. Long-term commitment by all stakeholders is essential.

Recommendation 17. Ensure collaboration between governmental organizations, e.g., DoA and NATC.

Recommendation 18. Develop different up-scaling approaches based on the segmentation of farmers: small-scale, medium-scale, large scale (training, access to finance, access to inputs, etc.).

Greenhouse horticulture in Malaysia

Policy Brief

Justification

This policy brief has been prepared under the responsibility of the Wageningen UR project team:

Anne Elings, Wageningen UR Greenhouse Horticulture — project leader.
Ineke Stijger, Wageningen UR Greenhouse Horticulture — plant protection specialist.
Monika Sopov, Wageningen UR Centre for Development Innovation — capacity building specialist.
Jouke Campen, Wageningen UR Greenhouse Horticulture — greenhouse specialist.

May 2012

Wageningen UR Greenhouse Horticulture
PO Box 644, 6700 AP Wageningen, The Netherlands
T: + 31 317 48 60 01
F:: +31 317 41 80 94
anne.elings@wur.nl
www.glastuinbouw.wur.nl

Wageningen UR Centre for Development Innovation
PO Box 88, 6700 AB Wageningen, The Netherlands
T: + 31 317 48 14 04
F: +31 317 41 68 01
monika.sopov@wur.nl
www.cdi.wur.nl