Sustainable Vegetable Production and Marketing in Tianjin (China)

Final Project Report

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PREFACE

As a result of the economic reform the agri-food sector in China is changing drastically. Within a rather short period the situation shiftged from a shortage to a surplus situation. One of the major challenges for the coming decades will be to transform from a production-oriented towards a consumer-oriented sector. The sector has to meet an increasing demand for high quality food, due to consumer concerns with respect to health and environment. In this context LEI took the initiative for a project to improve the vegetable supply chain in Tianjin, one of the biggest cities of China. For that purpose a consortium of Dutch and Chinese research institutions and private companies has been established. The project, carried out from November 2000 till November 2002, was supported by the Asia-facility, a subsidy programme of the Dutch government to strengthen the co-operation between the Netherlands and countries in Asia. The project included the provision of Dutch vegetable seeds and greenhouse equipment, but was mainly focussed on knowledge transfer trough seminars, courses and on-the-job training. The activities resulted in substantial improvements in the vegetable supply chain with respect to production and marketing. The project progress and results are described this final report and separate reports on (a) marketing, (b) consumer preferences, (c) the use of agro-chemicals (farm monitoring), and (d) extension in Tianjin.

We express our thanks to our Dutch and Chinese partners in the project, in particular the staff of the institutions and companies who were directly involved in the project as well as the growers at the different project locations. We would also like to thank the Tianjin government for its valuable financial and institutional support.

There is, however, still a long way to go, given the situation that the supply chain concept is rather new in China and not always well understood by all relevant actors in the chain and around it. Growers are missing basic knowledge on the required production techniques, traders are not well informed on market developments and marketing approaches and the research and extension capacities in Tianjin are inadequate to fill these gaps at short notice. We hope and expect that this project has laid the foundation for establishing sustainable business and research relations between Tianjin and the Netherlands.

Prof. Dr. L.C. Zachariasse
General director LEI B.V.

1 PROJECT SYNOPSIS

1.1 Project background

The development of China towards a market led economy has substantially stimulated vegetable production. Within a short period, the vegetable industry has shifted from a shortage to a surplus economy and has to meet an increasing demand for high quality food due to consumer concerns with respect to health and environment. In Tianjin, the fourth largest city of China, about 120 km south east of Beijing, vegetable production is mainly based on small size, single-household units. The major market outlets are the large urban centres of Tianjin and Beijing. Furthermore Tianjin is the second largest harbour city (next to Shanghai), which creates opportunities to export vegetables to the Southeast Asian markets (including Japan). However, currently the production is hampered by the use of low quality seeds and inadequate production procedures. The research and extension infrastructure, which supports growers in these fields, is insufficiently market and client oriented and does not effectively reach the growers.
The Tianjin Municipality government is therefore supporting the development of modern client oriented agricultural support services. In this field the Tianjin Academy of Agricultural Sciences (TAAS) plays an important role. Through re-orienting its research, training and extension activities TAAS tries to foster sustainable vegetable production that meets the consumers demand.

Figure 1.1 Location of Tianjin in China

In this context TAAS looked at possibilities for support by Dutch institutions and companies given the advanced horticultural industry in the Netherlands. The Asia-facility, a subsidy programme of the Dutch government to strengthen the co-operation between the Netherlands and countries in Asia, offered an opportunity for making these plans concrete. A consortium has been established of Dutch and Chinese research institutions and private companies. The Dutch partners in the consortium are the Agricultural Economics Research Institute (LEI), Plant Research International (PRI), International Agricultural Centre (IAC), Rijk Zwaan BV (seed company) and Stolze BV (greenhouse equipment). The major Chinese partners are the Tianjin Academy of Agricultural Sciences (TAAS), the Tianjin

Agricultural Demonstration Centre for New and Advanced Technology (TADC) and the Vegetable and Fruit Service Company of Xinkou Town. This consortium prepared a project plan to support sustainable vegetable production in Tianjin. In November 2000 the proposal was approved by the Dutch governmental agency "Senter" that manages the Asia Facility.

1.2 Project objectives and expected outputs

The major objectives of the project were:

- To strengthen the research and extension capacities of TAAS;
- To foster the development of sustainable vegetable production by small growers in Tianjin;
- To improve the effectiveness and efficiency of the vegetable marketing chain in the Tianjin area.

The expected project outputs can be divided into three categories:

A. Environmental, Health and Agronomic improvements
   - The application of Good Agricultural Practices
   - Reduced environmental load
   - Improved product quality
   - The use of hybrid seed material
   - The utilisation of new locally adapted technologies, irrigation systems, etc.

B. Improved marketing of vegetables
   - Direct linkages in the vegetable supply chain with options for exports
   - Improved logistics and marketing systems

C. More market oriented research and extension
   - A client-oriented approach in research and extension at TAAS
   - Modernised demonstration fields and extension facilities
   - Trained staff
   - Improved relation with pilot growers

The project has been executed in Tianjin within the premises of the Tianjin Agricultural Demonstration Centre for New and Advanced Technology (TADC). This demonstration centre is a subsidiary of the Tianjin Academy of Agricultural Sciences (TAAS). Furthermore a group of satellite farmers has been selected from communities in Tianjin for inclusion in the demonstration and training activities.

1.3 Project activities

According to the original project proposal the project should last 24 months and start from September 2000, but following the approved plan the project started in November and should be completed in April 2002. Following an evaluation in November 2001 a revision has been proposed and approved by Senter. In the revised project plan the project deadline was postponed to October 2002, which made it possible to include the spring season 2002 in the project activities. Additional two months were required for reporting. The following description of activities refers to the final planning of activities from November 2000 till December 2002.

Phase 1 Inception phase (November - December 2000)

Task 1.1: Identification mission
Task 1.2: Exploring vegetable supply chain
Task 1.3: Identifying additional commercial partners
Task 1.4: Selecting satellite growers
Task 1.5: Project team building
Task 1.6: Start-up seminar
Task 1.7: Take go-no-go decision on development options

Phase 2 Institution building phase (January – March 2001)

Task 2.1: Training of trainers in the Netherlands
Task 2.2: Development of extension curriculum
Task 2.3: Extension meetings with growers
Task 2.4: Preparation of demonstration fields
Task 2.5: Supply chain & marketing workshops
Task 2.6: Preparation of monitoring systems
Task 2.7: Steering committee meeting
Task 2.8: Supply seed and other material

Phase 3 Pilot implementation phase (April - August 2001)

Task 3.1: Provide agronomic advice to growers
Task 3.2: Organise demonstration days at TAAS and satellite farms
Task 3.3: Collect and process farm and market data
Task 3.4: Provide on-the-job training of TAAS staff
Task 3.5: Intensify relations in the supply chain
Task 3.6: Organise project team workshops

Phase 4 Institutional strengthening phase: (September 2001 – June 2002)

Task 4.1: Analyse data of monitoring systems
Task 4.2: Organise refresher courses for trainers
Task 4.3: Organise extension courses for growers
Task 4.4: Organise workshop with project stakeholders
Task 4.5: Organise action plan for follow-up

Phase 5 Evaluation phase (July – November 2002)

Task 5.1: Provide seeds etceteras for second season
Task 5.2: Evaluation project results
Task 5.3: Organise start-up meetings for follow-up
Task 5.4: Organise national/international seminar in Tianjin
Task 5.5: Organise steering committee meeting

1.4 Project inputs

The Dutch organisations in the project consortium had long-term experience in the field of research and extension in agriculture. They have focussed their activities on different aspects of the chain:

- Agricultural Economics Research Institute (LEI): Market Chain Development, Market Analysis
- Plant Research International (PRI): Farming Systems, Monitoring Systems
- International Agricultural Centre (IAC): Extension Systems, Training
- Rijk Zwaan BV: Supply of seed material
- Stolze BV: Supply of equipment

The total input of human resources was about 1250 man-days, of which the Chinese partners provided more than half. The division of man-days between the Dutch partners was roughly as follows: LEI about 50% (including project management), PRI 25%, IAC 10%, Rijk Zwaan 10 % en Stolze 5 %. Rijk Zwaan provided vegetable seed material for about 50,000 Euro and Stolze equipment for about 20,000 Euro, of which 50% on their own account and 50% financed by the project. The Tianjin Academy of Agricultural Sciences (TAAS) provided the required human resources, demonstration fields and other facilities for research and extension particular via the Tianjin Agricultural Demonstration Centre for New and Advanced Technology (TADC). The other Chinese partner in the project was the Vegetable and Fruit Service Company of Xinkou Town, which provided demonstration sites and contributed in extension, monitoring and marketing. Another Chinese company, Tianjin Defeng Modern Agricultural Development Co., was planned to be involved in marketing but that did not materialise.

1.5 Project organisation

The following figure shows the organisational structure of the project. Each of the Netherlands companies and research & training institutes provided experts who participated in the project team. Mr. Ben Kamphuis from LEI was the project manager. The project team was directly responsible to Senter and was advised by a team of senior experts (both Chinese and Dutch) representing the steering committee.

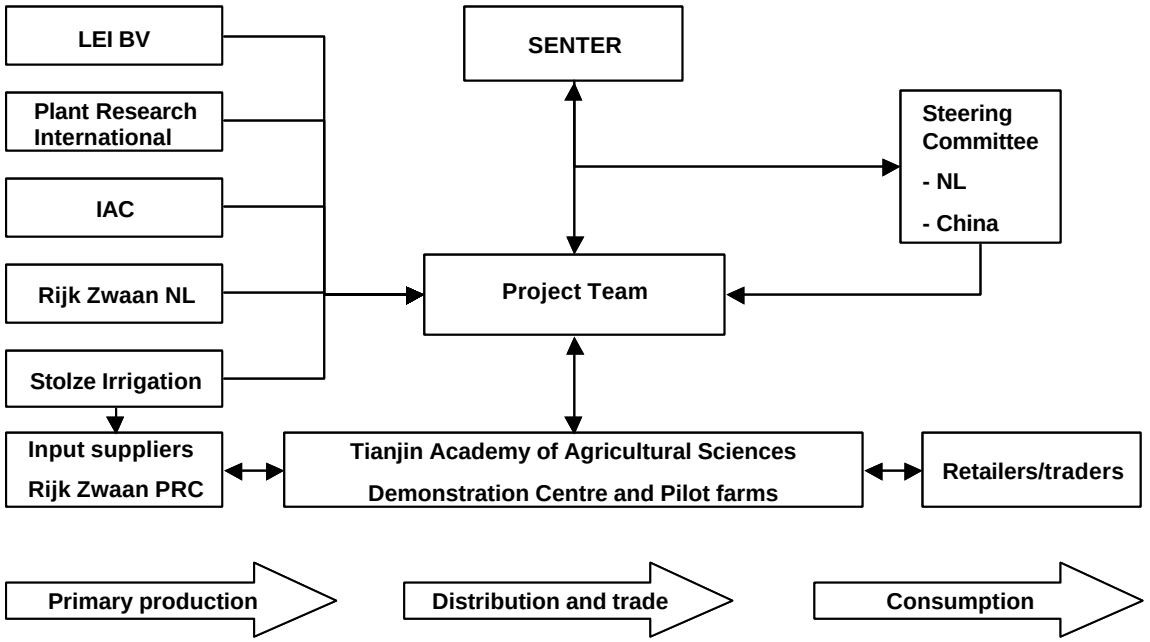


Figure 1.2 Project organisation

1.6 Project budget

The total project budget amounted to about 450,000 Euro, of which over 80 % was financed by the so-called Asia Facility. The participating private Dutch companies (Rijk Zwaan and Stolze) contributed 50% of their share in the project from their own means. Rijk Zwaan provided substantially more seed than was foreseen in the project proposal on its own account.
The Chinese counterparts invested in the project through the provision of demonstration fields and other facilities for research and extension, the man-hours spent to the project, the organisation of project meetings, (international) seminars and transport of experts in China and a few international flights. Part of the costs was paid by TAAS from its own means, but also the Tianjin municipality government contributed to the project.

2 PROJECT ACTIVITIES

2.1 Phase 1. Inception phase (November - December 2000)

Task 1.1: Identification mission

The identification mission took place in November 2000. During the mission the Dutch project partners met representatives of all major stakeholders in the project and discussed with them the project goals and activities. The mission resulted in a common understanding on the project, which was expressed in a co-operation agreement between LEI as leading partner in the project and TAAS. During meetings with the vice-major and other high officials of the Tianjin municipality government it became clear that not only TAAS but also governmental institutions at local and municipality level supported the project. Rijk Zwaan and Stolze visited Tianjin in December to make the final agreements on the provision of seed and equipment.

Task 1.2: Exploring vegetable supply chain

During the identification mission the physical, economic and institutional setting of the project have been explored in detail. Via site visits and meetings with staff of different organisations a more detailed picture could be drawn of the farm structure in Tianjin, the relations between the farms and other businesses in the vegetable supply chain, the position of governmental and other public organisations at different levels and the technical situation on the farms.

Task 1.3: Identifying additional commercial partners

Figure 2.1 Tianjin Agricultural Demonstration Centre for New and Advanced Technology

The intention was to identify additional commercial partners in the project, in particular traders and retailers that were willing to buy (and sell) the vegetables produced by TADC and the involved growers. Meetings have been held with some retailers, amongst others with the Japanese retail chain Daiei and the French one, Carrefour. It was planned that Tianjin Defeng Modern Agricultural Development Co. should take part in selling the produce, but TADC and Xinkou town government made clear that they expected to be able to absorb the production, even in the case that the project should cover a larger area than was foreseen in the project proposal. It was therefore not necessary to invite other Chinese companies to participate in the project. TADC intended to play a central role in the marketing itself and, indeed, in the course of the project TADC succeeded in establishing a commercial network, including two supermarket chains.

Task 1.4: Selecting satellite growers

It was planned that about 20 greenhouses should be included in the project for testing and demonstration purposes, of which four greenhouses at TADC that should be improved with Dutch technologies. In stead of that TADC and Xinkou town proposed to include about 100 greenhouses in the project, most of them Chinese "sunlight greenhouses", plastic covered greenhouses of about one

mu (1 mu = 667 m2) with a brick or clay wall about 3 meters high on the northern side and a plastic dome on the southern side (See the pictures in this report).
After further consultations the following number of greenhouses were included in the project:

- TADC (12 greenhouses)
  11 sunlight greenhouses and 1 larger greenhouse (Hard plastic covered (French) greenhouse)
- Xinkou Town, Liu Fu (44 greenhouses)
  23 sunlight greenhouses, 20 recently built sunlight greenhouses and 1 larger greenhouse
- Xinkou town, Dang Chen (35 greenhouses)
  35 newly built sunlight greenhouses in a new "Pollution Free" Production area

Figure 2.2 Project location Liu Fu

The 44 greenhouses in Liu Fu were the property of a company of which the village and six individual farmers are the main shareholders. The village provided the investments for the new greenhouses; the six farmers/shareholders were responsible for growing and marketing the crops. Seasonal labourers, however, provided most of the labour.
The situation in Dang Chen was different. Forty growers had established a Growers' Association for Pollution Free Vegetable Production on the instigation of the Xinkou Agricultural Bureau. Seven out of these forty growers built the 35 new greenhouses. These seven were selected by the Bureau and received loans from an agricultural bank to build the greenhouses. The Xinkou government guaranteed these loans but the seven concerned growers were personally responsible for the repayment.

Task 1.5: Project team building

While preparing the project and the identification mission the Dutch partners in the project established sound working relations. The integration with the Chinese project partners was built up during the identification mission and the following missions. Important in this respect was also the training in the Netherlands in March 2001. Furthermore the warm welcome at different occasions by different institutions in Tianjin contributed much to the project spirit.

Task 1.6: Start-up seminar

During the identification mission the Dutch and Chinese partners met regularly in plenary and bilateral meetings. The identification mission was concluded with a joint meeting at TADC and a meeting with some high officials of the Tianjin municipality government, including the Vice-mayor, Mr. Sun Hailin.

Task 1.7: Take go-no-go decision on development options

In addition to the decision on the greenhouses to be included in the project, decisions have been taken on:

- The provision of seed by Rijk Zwaan
- The specification of the Dutch equipment to be installed in TADC greenhouses by Stolze.
- The contents and approach of the farm monitoring system.
- The timing and contents of the training of eight Chinese experts in the Netherlands.
- The preliminary timing and contents of project seminars and workshops.

These agreements were included in a co-operation agreement signed by the project manager and Prof. Lu Kaixuan, the president of TAAS.

2.2 Phase 2. Institution building phase (January – March 2001)

Task 2.1: Training of trainers in the Netherlands

Eight experts from Tianjin participated in the training that took place from March 16 till April 3. Two of them went in training to PRI for the monitoring system. The other six people followed an intensive course on extension methodologies at IAC and took part in a training at Rijk Zwaan that covered all the aspects of the vegetable supply chain, in particular the cultivation of vegetables in greenhouses. Marketing was one of the major topics during the last part of the training that was delivered by LEI. See programme in Appendix 1.

Task 2.2: Development of extension curriculum

The extension training in the Netherlands in March 2001 was focussed on the introduction of modern methods of extension and advise to farmers. After that, the IAC expert went two times to Tianjin for intensive consultations with TADC and Xinkou town staff and growers in order to determine an extension approach that suits the specific local circumstances. It was, however, not possible to design a definitive approach, mainly because of the following circumstances:

- TADC was concentrating on improving the technical and economic results on its own premises and did not have a clear vision on its role as a "demonstration centre". There was also a lack of skilled personnel for extension activities.
- The capacity of Xinkou Town Agricultural Bureau was also limited and the technology that was introduced was as new for the Bureau's extension personnel as it was for the growers.

In the course of the project the extension activities of TADC increased but did not yet result into an all year round extension programme. See also the report on Extension in Tianjin.

Task 2.3: Extension meetings with growers

Staff of TADC and Xinkou town visited the demonstration centre of Rijk Zwaan in Qindao and Shouguang in December 2000, January and February 2001, so that they were better capable to give advise to the growers. Rijk Zwaan delivered also a lecture on cultivation for the growers at TADC and visited the project locations a few times. The growers in Xinkou town received mainly advice from the local extension service.

Task 2.4: Preparation of demonstration fields

At TADC 12 greenhouses were used for demonstration purposes in the project. In Xinkou town two new complexes of greenhouses have been constructed (Liu Fu 2 and Dang Chen) in addition to the already existing complex (Liu Fu 1). Caused by a late freeze the new greenhouses were later completed than foreseen, but eventually the growers succeeded in transplanting the seedlings (grown at TADC nursery) in the first week of April 2001. The total 80 greenhouses are included in the project. Most of them are traditional Chinese type sunlight greenhouses, except for two larger French ones. There are some differences in construction and used material. See pictures in this report.

Task 2.5: Supply chain & marketing workshops

Marketing was one of the major topics during the training in the Netherlands and during every mission to Tianjin this topic was on the agenda. On September 20 and 21, 2001 an "Agri Food Supply Chain Seminar" was organised, which was aimed at informing a broader audience in Tianjin on the supply chain concept. Besides staff of LEI and Rijk Zwaan also representatives of SGS and Syngenta provided a lecture. See programme in Appendix 2.

Task 2.6: Preparation of monitoring systems

In order to be able to advise the growers on healthy and environmentally friendly vegetable production in line with the regulation of Pollution Free Vegetable production, it was necessary to get a clear picture on the agricultural practices in Tianjin. For that purpose a farm monitoring system was introduced. During the training in the Netherlands and following missions to Tianjin in April and May 2001, the experts of PRI provided assistance to the implementation of the system at the three project locations: TADC, Liu Fu and Dang Chen.

Figure 2.3 Farm monitoring system

The monitoring consisted of two parts:
- Daily book keeping by the growers on the inputs of fertilisers, water, pesticides, energy and labour and outputs of products for each greenhouse separately;
- Chemical analysis of soil (N, P, K, mineral N, Ec, pH and heavy metals), irrigation water (nitrate, Ec and pH) and ground water (nitrate) and plants (N, P, K, nitrate, vitamin C, sugar and pesticide residues in products and N, P and K in plant residues). For logistic and financial reasons only part of the greenhouses delivered samples for chemical analysis.

In the spring season of 2001 in total 80 greenhouses were involved in the monitoring system. In the autumn season of 2001 monitoring only took place at TADC, with chemical analysis only in three greenhouses with cucumber. Furthermore, inputs and outputs were recorded in five greenhouses with tomato, sweet pepper and eggplant.
In the spring season of 2002, 46 greenhouses with cucumber and tomato were monitored. The monitoring system was less complete than in the first year. Samples for chemical analyses were only taken in the greenhouses with the new fertigation equipment provided by the project to TADC.

Task 2.7: Steering committee meeting

The steering committee did not convene in the first stage of the project like it was planned, in particular because the Chinese members did not have the opportunity to come to the Netherlands. They proposed to send another delegation, but in consultation with Senter it was decided to look for a more suitable time later in the year. The Chinese delegation came to the Netherlands in November 2001. In the meantime the Dutch team had regular contact with Prof. Lu KaiXuan (TAAS) en Drs. P. Boon (Netherlands Business Support Office in Tianjin), both members of the steering committee.
In July 2001, a delegation from Tianjin under the lead of Vice-Mayor Mr. Sun Hailin visited the Netherlands and met some of the Dutch project partners and the Dutch Ministry of Agriculture to explore the possibilities for following projects. During a meeting in December 2001 representatives of the Dutch and Chinese project team and Chinese members of the steering committee discussed the project progress and took decisions on the project activities in the second and possible follow-up projects.

Task 2.8: Supply of seed and other material

In December 2000 *Rijk Zwaan* made the first delivery of seed, just in time for the spring season. It was mainly seed of mini cucumber, sweet pepper, tomato and eggplant for production and some other seeds for test and demonstration purposes at TADC. In August 2001 Rijk Zwaan delivered seed for the autumn/winter season and in December 2001 seed for the spring season 2002. The amount of seed required for all the greenhouses involved in the project was much more than budgeted, but Rijk Zwaan delivered the additional amount on its own account (about one third).

Fig 2.4 Rijk Zwaan

Soon after the identification mission a decision was taken on the equipment that should be delivered by *Stolze* at TADC. The installation, however, was delayed several times, partly because of administrative reasons. Finally, the new equipment was installed in February 2002, just in time for the spring/summer season. It was equipment for fertigation in two greenhouses and for ventilation in one, including a process computer and instruments for weather recording.

2.3 Phase 3. Pilot implementation phase (April - August 2001)

Task 3.1: Provide agronomic advice to growers

The day to day agronomic advise to the growers was provided by staff of TADC and Xinkou Town's Extension Service. Some of them had visited the demonstration centres of Rijk Zwaan in Qindao and Shouguang for getting acquainted with the cultivation techniques required for the Dutch varieties. Rijk Zwaan provided additional information via a lecture at TADC and by visiting the three project locations for direct advice to the growers. During the growing season staff of TADC consulted Rijk Zwaan a several times on specific questions, in particular with respect to pest control. In course of the project TADC and Rijk Zwaan established sound business relations.

Task 3.2: Organise demonstration days at TAAS and satellite farms

At the start of the project it was assumed that the growers in the project area would be reluctant in adopting the new technologies from the Netherlands and that it would be necessary to set up a series of demonstration activities. It appeared, however, that the growers in general are very open for innovations and the project was, therefore, not involved in the organisation of special demonstration days. Despite of that, many people visited TADC and the project locations in Xinkou town for information on the Dutch varieties. In one year the number of visitors to TADC amounted to more that 25,000 and the Dutch experts provided advise on the organisation of these visits and adequate provisions at TADC.

Task 3.3: Collect and process farm and market data

The growers recorded the requested *farm data* on the forms that were made available for every greenhouse. They did it on a daily basis, which could be checked during the missions. TADC and Xinkou town staff collected the forms, but they did not process the data directly after data collection as

it was planned, so that it was necessary for PRI to put more effort in data processing than it was foreseen.
TADC collected *market data* on a daily basis, but not in a structured way. Therefore possibilities for the establishment of a professional market information system have been explored. LEI provided TADC with an MS-Access database that could be altered into a market price monitoring system tailor-made for TADC. At the end of the project a provisional system was under construction.
In October 2001 *LEI carried out a consumer survey* in collaboration with the Agricultural College of Tianjin. Students of the Agricultural College interviewed 300 consumers in Tianjin. LEI did the analysis. The results have been published in a separate report: Dr. Xiaoyong Zhang, "Tianjin consumer study, with special attention to food safety". See Appendix 3 for table of contents.

Task 3.4: Provide on-the-job training of TAAS staff

During all the missions the Dutch experts provided advise on cultivation and marketing. They also worked with the Chinese experts on the development and implementation of the monitoring system and on a suitable approach for the extension system.

Task 3.5: Intensify relations in the supply chain

TADC worked hard on intensifying the relations in the supply chain, amongst others trough its recently established commercial subsidiary, "Tianjin Nongpeng Agricultural Development Co. Ltd. The centre succeeded in concluding contracts with supermarket chains in Tianjin. TADC took the initiative for establishing a new association for the production and marketing of pollution free vegetables, the so-called Tianjin Country Special Technological Confraternity (CSTC). TADC was also recognised as a certified producer of Pollution Free Vegetables by the Tianjin authorities.

Task 3.6: Organise project team workshops

During all missions to Tianjin the Dutch and Chinese experts worked intensively together on the different project components, sometimes in smaller groups, sometimes with the whole team.

2.4 Phase 4. Institutional strengthening phase (Sept. 2001 – June 2002)

Task 4.1 Analyse data of farm monitoring systems

a. Farm monitoring spring season 2001
The first results of the data analysis on spring season 2001 were presented on a seminar at TADC on Friday, December 7, 2001. About 25 people attended the seminar, from TADC, TAAS, Xinkou Town Station of Science and Technology, Xiqing Agricultural Demonstration Park, Jinghai Bureau of Agriculture and Xishuang village in Jinghai County.

b. Farm monitoring winter season 2001/02
TADC recorded the development in the four greenhouses with newly installed heating systems. It was expected that extra technical data should be collected following the regulations for "Pollution Free Vegetable Growing", but these data have not been made available. Furthermore data were collected in five greenhouses with tomato, sweet pepper and eggplant. These crops produced very poorly in autumn and were kept over winter to produce mainly in January and May.

c. Farm monitoring spring season 2002
The research during the spring season 2002 was focussed on the impact of improved techniques for fertigation and ventilation on the performance of Dutch varieties. For that purpose the two greenhouses with the newly installed control equipment and a control group of two other greenhouses have been monitored. The larger parts of these four test greenhouses were planted with the Dutch mini cucumber variety Deltastar, minor parts with Chinese varieties. In addition to this four test greenhouses data were collected in about 40 other greenhouses at TADC and the other project locations.

d. Analysis and reporting
The soil, water and plant samples were analysed by the Central Laboratory of TAAS. TADC and Xinkou Town Extension Service collected the farm monitoring data. The contribution of TAAS staff in data analysis and reporting was minimal. Plant Research International carried out the major part. For that purpose a fellow-researcher of the institute was involved in the project as well as a student who stayed in Tianjin from July till December 2002. The definitive results have been published in: Monforte, N. & W.J. Corré, 2003, "Development of sustainable vegetable production in Tianjin (China): report of a monitoring study". Plant Research International, Wageningen, The Netherlands. See contents in Appendix 4.

Task 4.2 Organise refresher courses for trainers

After the first season, missing "green fingers" (i.e. skills in crop management) at TADC was considered as the weakest link in the Tianjin Vegetable Supply Chain. For that reason it was decided to focus the project activities more on strengthening the vegetable production capacity at TADC in stead of its function as an extension and demonstration site. Rijk Zwaan took the major responsibility inn providing assistance on crop management to TADC staff. LEI provided advice on improvement of the extension and demonstration activities. The following activities took place:

a. General training in Qingdao (October 2001)
Nine people from Tianjin took part in a training course in Qingdao from 27 till 29th of October 2001: three from TADC, three from Xishuangtang, two from Liu Fu and one from Dang Cheng. Besides Rijk Zwaan staff three professors of the China Agricultural University Beijing and one professor of Shenyang Agricultural University contributed to the training. A major part of the course was spent to cultivation techniques. See training programme in Appendix 5.

b. On-the-job nursery and crop management training in Qingdao
One of the mid-term recommendations for TADC was to give the junior staff the opportunity for longer-term training at advanced demonstration centres like the one of Rijk Zwaan or with professional growers. However, the scheduled training visits to Qingdao were cancelled for different reasons. Instead of that two junior staff accompanied the Dutch experts at a visit to Qingdao on December 8/9 2001, so that they could discuss different aspects of crop management with Rijk Zwaan experts.

Fig. 2.5 Demonstration and testing site of Rijk Zwaan in Qingdao

c. Study tour Shouguang
On April 20-22, 2002, a delegation of TADC went to Shouguang (Shangdong Province) to visit a large horticultural fair, the demonstration centre of Rijk Zwaan and growers in that region. The group consisted of junior and senior staff of TADC, working in cultivation or marketing, and three LEI staff. The visit was organised and guided by Rijk Zwaan and considered to be very instructive, not only with respect to cultivation techniques, but also with respect to marketing because of several meetings with traders at the wholesale market and at Rijk Zwaan's demonstration centre.

d. Lectures by Rijk Zwaan staff at TADC
Staff of Rijk Zwaan visited Tianjin several times during the growing season and provided advise on crop management. Apart from on the spot advise during their inspections of the greenhouses at the

project locations, they gave some lectures at TADC for people from different counties of Tianjin on the following topics: pest and disease control, cultivation techniques, soil treatment and marketing.

Another possibility for training of trainers is given by the Sino-Dutch Horticultural Training and Demonstration Centre (SIDHOC) in Shanghai. Some of the Dutch experts visited that centre and discussed the possibilities for co-operation and training with the SIDHOC staff. TADC management has been briefed about the possibilities, but that did not yet result in concrete steps.

Task 4.3 Organise extension courses for growers

a. Developing extension curriculum

As it has been mentioned before (task 2.2) it appeared to be difficult to develop a professional extension curriculum at TADC because of the conflicting demonstration and commercial functions of the centre and the lack of expertise and knowledge in the field of vegetable growing. Yet TADC took the initiative for the establishment of an association of small and medium sized agricultural and trade companies, research and extension organisations and governmental institutions involved in agricultural sector in Tianjin. Through this association TADC can bring new technologies to the attention of extension services at county and town level and via them to the small growers. In 2002 TADC organised seven information meetings for the members of CSTC, for instance on the selection of crops and varieties, cultivation techniques and marketing. Senior technical experts of TADC started also to visit interested farmers' groups of companies for the introduction of Dutch vegetables. These activities, however, were mostly organised in an ad hoc way and did not (yet) fit into a well-considered framework. An overview of the situation with respect to the agricultural extension system in Tianjin and a summary of the recommendations for improvement are given in a separate report:
Ben Kamphuis, Nol Verhaegh, Xiaoyong Zhang, 2003,"Agricultural Extension in China; Case Tianjin", LEI, The Hague, The Netherlands. See table of contents in Appendix 6.

b. Demonstration days at TADC

Many people from other counties/villages around Tianjin visited the demonstration centre, varying from pupils from primary and secondary schools till high-level administrators. In total more than 25,000 people visited TADC in 2001 and 24,000 in 2002. In May 2002 TADC organised a fair on agricultural science and technology in the framework of the "Tianjin Popularity Week of Science and Technology". About 1,700 people came to see the facilities of TADC and the product show of TAAS institutes and commercial companies. Rijk Zwaan contributed to this event with demonstration material and lectures, on modern vegetable cultivation and Pollution Free Vegetable production. The project was not involved in the organisation of these demonstration visits, but some options for improvement of the demonstration facilities have been discussed with TADC management and have been realised.

c. Developing extension material

TADC has started to prepare training material: articles have been written on Dutch vegetables in a weekly Magazine on Science and Technology and copies are available for interested farmers. Further extension material was required, amongst others in the form of brochures/leaflets with cultivation guidelines for the different crops. For that purpose the Dutch experts provided TADC with some reports on the cultivation of cucumber, tomatoes and peppers as an example for drafting extension material for growers. This issue has been discussed further during the missions in 2002 and resulted in new posters in the demonstration room.

Fig. 2.6 Demonstration days at TADC

d. Site visits by Rijk Zwaan staff in Tianjin

The growers at TADC and the other locations in Tianjin considered the site visits of Rijk Zwaan's staff as very important events, because in that way the practical problems in crop management could be addressed. There is, however, still a big gap between the available and the required knowledge and skills of the growers so that Rijk Zwaan will continue with this type of after-sales services in the future.

Fig. 2.7 Project location Dangcheng

Task 4.4 Organise workshops with project stakeholders

The Dutch and Chinese project members met regularly during the missions of the Dutch experts to Tianjin. Other interested organisations and persons were invited for the project seminars on marketing (September 2001) and farm monitoring (December 2001). It was the intention to organise a marketing workshop, in particular for the marketing department of TADC (NongPeng Company) but instead of that they went to Shouguang like is it mentioned before, which amongst other things, lead to new trading contacts. During that study trip several exporters have been interviewed to get a better view on the export opportunities and constraints. The results of these interviews are described in a separate report on marketing. That report includes also a description of the marketing structure in Tianjin and the results of a SWOT analysis of NongPeng. Ben Kamphuis, Peter Ravensbergen, Xiaoyong Zhang, 2003, "Marketing of vegetables in China; Case study Tianjin", LEI, The Hague, The Netherlands. See table of contents in Appendix 7.

Task 4.5 Organise action plan for follow-up

a. Co-operation with Tianjin Scientific institutions

As a first step in strengthening the relations with Tianjin scientific institutions LEI staff provided lectures at the Agricultural College and the Nankai University about "Food safety policy in the world and the results of the Tianjin consumer survey on food safety". At the Agricultural College a few hundred students attended the lectures while the lectures at Nankai University were attended by about 25 people (Scientific staff and PhD students of the Economics Institute). Following these first contacts initiatives have been taken for further co-operation in scientific projects. Nankai University is preparing a proposal for joint projects with Wageningen University and Research Centre and TAAS submitted a project proposal to the central government that is aimed at the introduction of food safety approaches in vegetables, rice and poultry production in Tianjin.

LEI and PRI succeeded in getting approval for a follow-up project "Development of Sustainable Vegetable Systems in China (ChinaVeg)" in the frame of the International Co-operation Research Programme of Wageningen University and Research Centre in the Netherlands. TAAS submitted a proposal to the Chinese and Tianjin government for additional budget for a "Study on high efficient use of water and nutrients in sustainable vegetable production in the North of China". The proposed research will focus on cucumber and last two years (four successive seasons). In addition to TAAS Institute of Soils and Fertilisers and TAAS Central Laboratory, the Chinese Academy of Social Sciences (CASS, Institute for Rural Development) and the Nanjin Agricultural University will join the project team. The involvement of these institutions was necessary because of the limited research capacity with respect of agriculture at the Tianjin scientific institutions.

d. Tianjin flower industry

The Tianjin government is not only stimulating the vegetable sector in Tianjin but also the flower sector. Because of the leading role of the Netherlands in this field they want to strengthen the relation with the Dutch flower industry. For that purpose the different delegations that came to the Netherlands visited Dutch companies and made agreements on future business contacts.

The Dutch project partners tried also to get Dutch companies interested in a contribution to a flower exhibition in Tianjin that was held in the first week of October 2002. Some Dutch companies were interested but eventually the Netherlands was only represented by one company, basically because of already agreed contributions to other flower exhibitions in China, the late request of the organising committee and the specific character of the exhibition in Tianjin, being a National Flower Arrangement Contest. Alongside the exhibition a series of lectures were held on related topics. Mr. Ben Kamphuis was invited guest at the flower exhibition and delivered a lecture on Dutch floriculture, the flower supply chain and challenges for the Chinese flower industry.

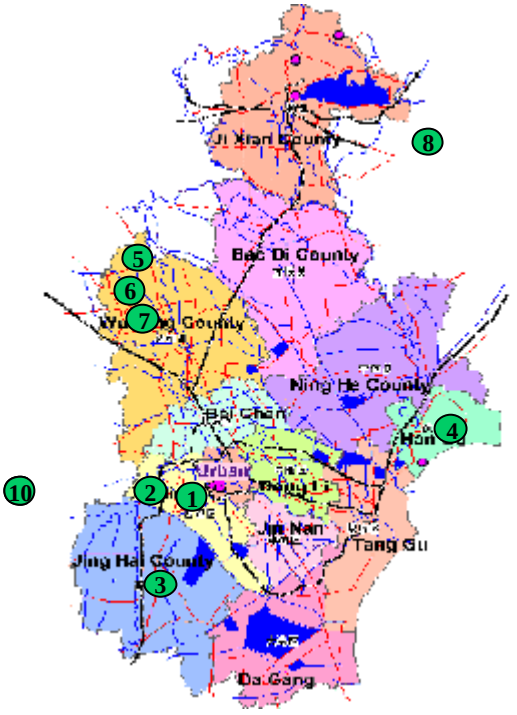
Some Dutch companies provided TADC with seeds and flower bulbs for testing purposes. Given the ambitions of the Tianjin government and business community it may be expected that business relations with Dutch companies will expand in the near future.

2.5 Phase 5. Evaluation phase (July – November 2002)

Task 5.1 Provision of seeds and other material

a. Seeds

- In December 2000 Rijk Zwaan delivered seed for the spring season, for about 100 greenhouses at TADC and two project locations in Xinkou town, mainly seed of mini-cucumber, tomato, eggplant and sweet pepper.
- In August 2001 they delivered seed for the autumn/winter season, for in total 13 greenhouses, of which four with cucumber, tomato and sweet pepper each and one with eggplant.
- In December the seed for the spring season 2002 was delivered, sufficient for 44 greenhouses with cucumber, 44 with tomato, 9 with sweet pepper, 13 with eggplant and 3 with melon.
- The amount of seed required for all the greenhouses involved in the project was much more than budgeted, but Rijk Zwaan delivered the additional amount on its own account (about one third of the total costs of the seed). Apart from the locations included in the project Rijk Zwaan is selling its seeds to more growers in Tianjin. See Map.



b. Equipment

- Before the start of the winter/spring season 2002 TADC had installed a (central) heating system in four greenhouses. The purpose was that the heating system should be connected with the climate control system, provided by the project, but unfortunately that equipment was not installed in time.
- In February/March 2002 Stolze B.V. installed the new equipment, i.e. equipment for fertigation in two greenhouses and for ventilation in one, including a process computer and instruments for weather recording.
- In addition to that the project provided TADC with a pH/EC meter, a light intensity meter and soil core samplers with the aim to foster a more professional approach at TADC so that better results could be achieved.
- TADC installed 10 cold stores to reduce the post-harvest losses and to enable them to anticipate more adequately to expected fluctuations in the market.

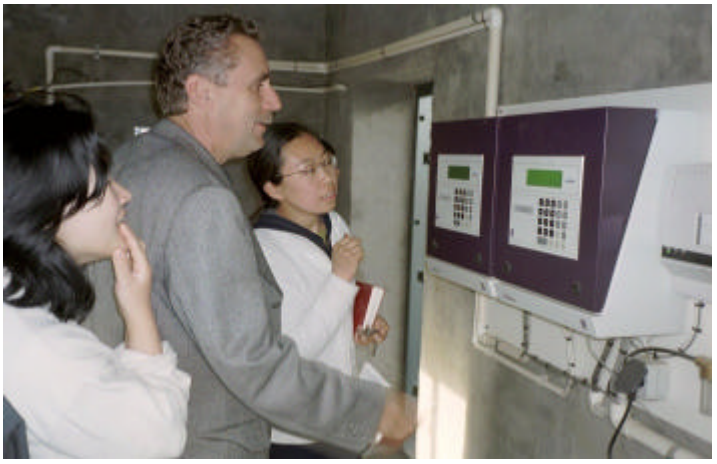



Fig. 2.9 Climate and fertigation control system

Task 5.2 Evaluation of project results

During the project implementation the results have been evaluated continuously in order to focus the activities on the most relevant issues. The results of the first project year were summarised in an interim report in November 2001. This report has been discussed in the Steering committee and the following mission to Tianjin, resulting in the request for postponement of project deadline from April towards October 2002. Senter approved the revision so that it was possible to continue the project activities during the spring season of 2002. A second interim report was issued in June 2002. That report formed the basis for the final evaluation that has been presented and discussed during final seminar in September 2002.

Task 5.3 Organise start-up meetings for follow-up

The proposal of the aforementioned follow-up project "ChinaVeg" has been elaborated into a working plan. LEI and its Chinese counterparts will focus on the marketing aspects and PRI and its partners on production aspects of sustainable vegetable production and marketing in China. CASS presented the first results of the marketing component of this project at the concluding seminar in September 2002.

Task 5.4 Organise national/international seminar in Tianjin

The results of the project have been presented and discussed at two seminars. The first one, on September 19, 2002, was focussed on growers, farm managers, extension services and other institutions directly involved in growing and marketing of vegetables and was aimed at formulating practical advice for vegetable growing and marketing in Tianjin.
The second seminar on September 20 was oriented on researchers and policy makers in Tianjin in order to discuss possible strategies for improving the performance of the Tianjin vegetable supply chain.
The first seminar was held at TADC and the second one at the Tianjin World Trade Centre. The presentations are summarised in a separate report. See Appendix 8.

Task 5.5 Organise steering committee meeting

During the seminar the present members of the steering committee discussed the results of the project and presented their conclusions.

2.6 Timing of the major missions

November 2000:	Identification mission by LEI, PRI and Rijk Zwaan.
December 2000:	Visits of TADC staff to Qingdao for introduction on Dutch vegetable growing.
December 2000:	Visit of Rijk Zwaan to Tianjin to conclude agreement on seed supply.
December 2000:	Visit of Stolze to Tianjin for specification of equipment to install.
Jan. /Feb. 2001:	Visits of TADC and Xinkou town staff to Qingdao for training on vegetable growing.
March 2001:	Training of Chinese staff in the Netherlands.
April 2001:	Mission of LEI, PRI and IAC to Tianjin on farm monitoring system and extension.
May 2001:	Mission of PRI and IAC to Tianjin on farm monitoring system and extension.
June 2001:	Mission of LEI on market issues and project progress.
July 2001:	Visit of Tianjin delegation of Mr. Sun Hailin to the Netherlands.
August 2001:	Mission of PRI to Tianjin on farm monitoring system.
September 2001:	Mission of LEI and Rijk Zwaan to Tianjin for Agri-Food Supply Chain Seminar.
October 2001:	Visits of TADC and Xinkou town staff to Qingdao for further training on vegetable growing and marketing.
November 2001:	Visit of steering committee to the Netherlands.
December 2001:	Mission of LEI and PRI to Tianjin for Farm Monitoring Seminar, project progress followed by visits to demonstration centres in Qingdao and Shanghai.
February 2002:	Visit of Stolze to install equipment at TADC.
Feb./March 2002	Mission of LEI to Tianjin on project progress and project follow-up and flower-exhibition.
March 2002:	Visit of Senter Programme manager to Tianjin for project evaluation.
March 2002:	Visit of representative of Dutch flower industry to Tianjin for meetings on contribution to Tianjin Flower exhibition in September/October.
March 2002:	Visit of Rijk Zwaan to Tianjin for inspection and technical advise, in particular on pests and disease control.
April 2002:	Mission of LEI to Tianjin for lectures at Nankai University, Agricultural College, project progress, extension and demonstration facilities, followed by visits to Shouguang and Qingdao for exploring market opportunities.
April 2002:	Visit of Rijk Zwaan to Tianjin and Xinkou town for inspection and technical advise
April 2002:	Visit of TADC staff to Shouguang horticultural fair, Rijk Zwaan demonstration centre, wholesale market and growers.
May 2002:	Visit of Rijk Zwaan to Tianjin for inspection and technical advise.
May 2002:	Visit of Rijk Zwaan to Tianjin for participation in agricultural science and technology exhibition at TADC.
June 2002:	Visit of PRI to Tianjin on monitoring system and project follow-up.
June 2002:	Visit of delegation from Tianjin to the Netherlands for preparation of flower exhibition.
July 2002:	Visit of Rijk Zwaan to Tianjin for inspection and technical advise.
August 2002:	Start stay of student at TADC for data collection and analysis.
August 2002:	Visit of Rijk Zwaan to Tianjin for inspection and technical advise
September 2002:	Missions of PRI and LEI to prepare final reports and concluding seminar.
September 19/20:	Concluding seminar.

3 EVALUATION OF PROJECT RESULTS

3.1 Tianjin Agricultural Demonstration Centre (TADC)

The main counterpart in the project was the Tianjin Agricultural Demonstration Centre for New and Advanced Technology of TAAS. The centre, established in 1998, was still in its starting phase, not all the buildings were in use yet and the staff was not complete. The senior staff was mainly recruited from other institutions of TAAS while the junior staff was mainly just graduated from the agricultural college. Both senior and junior staff had little experience in running a demonstration centre or growing vegetables. This had a negative impact on the progress of the project, but it created also possibilities to influence the developments easier than it might have been in case of a long-standing organisation.
TADC has four major demonstration divisions:

a. Modern horticulture
b. Experimental technology (in vitro cultivation)
c. Post-harvest technologies
d. Introduction of new species

In 2002 TADC took the initiative for the establishment of the Tianjin Country Special Technological Confraternity (CSTC) an association of agricultural and trade companies, research and extension organisations and governmental institutions. Through this association TADC can bring new technologies to the attention to interested organisation at local and county level in Tianjin. CSTC convened seven times at TADC for presentations and discussions on the selection of vegetables, cultivation techniques and marketing. The demonstration activities of TADC are mostly directly linked with the commercial functions of the centre. The CSTC, for instance, serves also as a network of producers that deliver vegetables to TADC on contract.
The focus at TADC is on commercial activities, because the centre needs to be self-supporting at short notice, meaning that it will receive less financial support from the Tianjin Government and TAAS. For that purpose TADC established a commercial subsidiary "Tianjin Nongpeng Agricultural Development Co. Ltd" and strengthen its position as a supplier of "Pollution Free Vegetables" through contacts with supermarket chains and traders and retailers.

Major conclusions

TADC is filling in its functions steadily, with new investments and new staff. The number of co-operating institutions and companies from different counties and towns is expanding. Although the commercial functions contribute to the continuation of the centre, they also form a threat to the demonstration and extension functions. This issue has been discussed a few times during the project with view on the project planning and implementation, but there not a clear strategy yet. The Dutch partners in the project recommended TADC to develop a business plan as a guideline for further developments in which the commercial and demonstration functions of the centre are well-balanced.

3.2 Production of "Pollution Free Vegetables"

The project was focused on sustainable vegetable production and fitted perfectly in the shortly before started policy of the central government to enhance the development of safe and environmental friendly food production. In Tianjin a special program for the introduction of Pollution Free Vegetables (PFV) was launched and the project supported that programme through its research and extension activities. Important in this respect is that from the start of the project a larger number of growers was included in the project than it was foreseen and the number is increasing. The project gave the participants the opportunity to compare Dutch and Chinese varieties. The project provided three times seed material, for the spring season 2001, the autumn/winter season 2001/2002 and the spring season 2002. The selection of crops and varieties was done in consultation between Rijk Zwaan PRC, TADC and the growers at the other locations. The focus was on four crops, mini cucumber, medium-sized tomato, sweet pepper and eggplant of which different varieties were delivered. Most seedlings were grown in the nursery of TADC but part of it in the Chinese greenhouses at the other locations. The quality of the seedlings was good, in general, but there is still much room for improvement. In both spring seasons a substantial part of the seedlings were transplanted late because the greenhouses were not yet ready for transplanting.

Yields per hectare

The production per hectare was not as high as it was anticipated. In the spring season 2001 the average yield of tomatoes was about 3.5 - 6.5 kg per m^2, for mini-cucumber 2.5 – 5.0 kg and for eggplant and sweet pepper even less than 2 kg per m^2. Although the Dutch varieties are known for their strong resistance against diseases, it appeared difficult for the growers in Tianjin to control diseases and pests. In the spring season of 2002 TADC succeeded in getting a better yield for mini-cucumber, but the results were still far below the yields in other production regions in China. The situation on the demonstration sites of Rijk Zwaan in Qingdao and Shouguang and of private growers in these regions showed that there are many possibilities for the Tianjin growers to improve the results. Yields of minimum 10 kg tomatoes or cucumber are very normal there. The poor results in Tianjin were partly caused by unfavourable physical (soil and water quality) and climatic conditions, but more important was the lack of knowledge, experience and skills of the staff and the workers in the greenhouses.

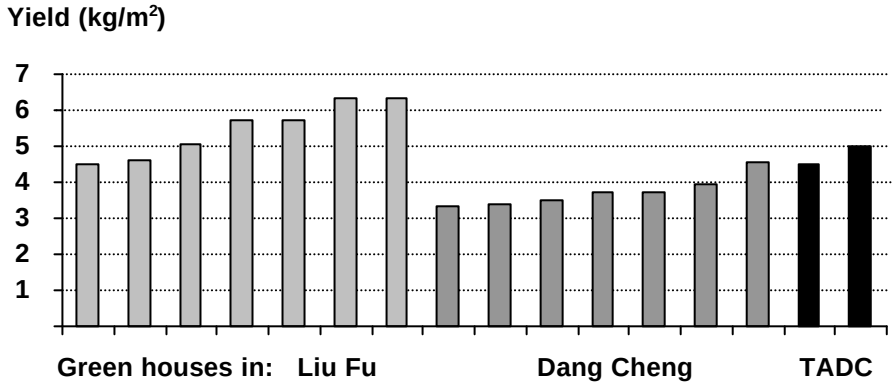


Figure 3.1 Yields per hectare tomatoes (Beril) at different locations in spring season 2001

Inputs and product quality

During the growing season the farmers kept daily books on the input and output per greenhouse. In addition to that chemical analysis were carried with respect to the quality of soil, irrigation water, ground water and plants.
In the spring season of 2001 in total 80 greenhouses were involved in the monitoring system, in the autumn season of 2001 only a few greenhouses at TADC and in the spring season of 2002 46 greenhouses, including the greenhouses with the new fertigation equipment. The major results of the monitoring system with respect to the quality of soil, water and products are the following:

- No hazardous pesticides were detected in the vegetables;
- Heavy metal contents of all soils were within the limits required for "Pollution Free" production;
- Inputs of nitrogen fertilizer, water and pesticides varied widely among the different locations and individual greenhouses and were in general high to very high;
- The production levels, however, did not show any relation with the amounts of inputs;
- In the greenhouses with the newly installed Dutch fertigation system the same production level was achieved with a much lower input of fertilizers, water and pesticides.

Major conclusions

The technical results at the project locations were reasonable, taking into account that most of the growers and staff at the project locations had only limited experience in growing crops in greenhouses in general and Dutch varieties in particular. Better results, however, are possible and necessary for surviving in the fierce competition on the vegetable market. Comparisons with other production regions and the results of the new fertigation equipment at TADC show that there are many opportunities for a more efficient and effective use of inputs. Lower costs, higher yields and less negative effects on the environment could be achieved with a simple drip irrigation system and more carefully planned fertiliser and pesticide applications. For that purpose the vegetable growers in Tianjin need more explicit guidelines on the management of crops and inputs to reach or maintain profitable production levels of good quality and safe vegetables. Also the staff at TADC need practical

training on how to manipulate the different growing factors by means of soil treatment, water supply, fertilisation, greenhouse climate control, topping, pruning etc. This cannot be learned from books or lectures. Long-term practical experience is needed and for that reason the project took the initiative for more training on cultivation techniques. The conclusion, however, is that further practical training is needed, that can be obtained in different ways. A good starting point for that form the sound business relations that have been established between Rijk Zwaan and TADC and other extension services and companies in Tianjin during the project.

Fig. 3.2 Pollution Free Vegetables

Generally speaking the growers in Tianjin are aware of the increasing consumer interest in "pollution free vegetables", but the consequences for crop management, e.g. with respect to the use of agro-chemicals are not yet implemented. The monitoring system introduced in the project was partly considered as a burden for TAAS, TADC and the growers. The increasing demand, however, for high quality vegetables and the growing consumer concerns with respect to food safety in China and importing countries like Japan, require a reliable quality control system, including the monitoring activities introduced in this project. Instead of an ad-hoc control system focussing on the quality of the final product, a routine system needs to be developed covering the whole supply chain. TADC took the lead in this respect by acting as an intermediate between producers and traders/retailers, but further integration in the vegetable supply chain will be necessary in order to meet the demands.

3.3 Marketing

At the start of the project TADC sold its produce mainly via wholesale and street markets. During the project period TADC succeeded in finding new outlets. Contracts have been concluded with small retailers, supermarket chains and traders. An agreement was signed with an exporter to Russia. In order to strengthen its position on the market, TADC established a commercial subsidiary "Tianjin Nongpeng Agricultural Development Co. Ltd". Nongpeng is responsible for the commercial functions of TADC and strengthened its position as an intermediate between growers and traders. Over the year 2001 TADC sold about 40% of the production to supermarkets, 30 % through the wholesale market and the rest at TADC itself. Before the spring festival of 2002 TADC sold about 5500 present boxes with vegetables.
The growers in the project locations in Xinkou town did not succeed in building new market relations and are still rather dependent on the middlemen. About half of their production is collected at farm gate by middleman, about 20% is sold at local supermarkets or present boxes for large institutions and the rest via the local wholesale market and street markets.

Of the four new crops introduced by the project the *mini cucumber* in particular was a success. Even the third quality was easily sold. Also *tomatoes* could easily be sold. The cherry tomatoes are particularly in favour of children but because of an abundant supply the competition is fierce. It was not easy to sell the Dutch variety of *eggplants*; in particular the growers in Xinkou town could not find buyers, while they had ten greenhouses with eggplants. The local consumers were not familiar with

the long-shaped Dutch eggplant. They preferred the round-shaped Chinese varieties. The *sweet peppers* grown at TADC came late in production and sold green (before turning red) because of falling prices after the spring festival.
The market prices of the Dutch varieties are often but not always higher than those of the Chinese varieties. In particular the Delta-Star mini cucumber is rather popular and therefore the price is two times higher than for the Chinese cucumber. The coloured green peppers could be sold for a relative high price only during the spring festival. The medium sized tomatoes of Rijk Zwaan got a higher price in particular because of the longer shelve life. The price of cherry tomatoes dropped in 2002, both for the Chinese and Dutch varieties.

Figure 3.4 He-Zhuang-Zi Wholesale Market and Daiei Supermarket

Market prices are fluctuating considerably over the season. Generally speaking, the prices are higher in winter and early spring, and are lowest in summer. Vegetable prices reach their peak during Chinese New Year, normally in February. Since Nongpeng has invested in 10 cold stores, the company can easier react on fluctuations in the market. Compared with TADC, the average prices that Xinkou farmers received are lower. A possible reason could be the farmers' weak bargaining power over middlemen.

Major conclusions:
TADC succeeded in marketing the produced vegetables rather well. This is largely due to the pro-active approach of the marketing department of TADC, which established valuable trade relations, not only in Tianjin but also in Beijing and with exporters. It will be a challenge to keep the momentum, in particular because the market becomes increasingly quality-oriented. The consumers are becoming concerned about food safety, as it appears from the consumer survey that LEI carried out in Tianjin in 2001. Also the interviews under Chinese exporters in Shouguang in April in 2002 revealed that the importing countries, in particular Japan, set high quality standards, which cannot always be met by the Chinese producers. Food safety is also on the top of the agenda of the Chinese government now. The growers in Tianjin need to be prepared for these developments. TADC took a leading role by investments in cold stores and sorting, grading and packaging equipment. In addition to that a more active role of TADC in quality control and advice to growers is required to strengthen the supply chain of quality vegetables in Tianjin.

3.4 Extension and demonstration

Direct extension to farmers in China is rather limited and depends on available projects financed by governmental organisations at county or central level. The central task of TADC is to introduce new technologies, but at the start of the project the centre was more focussing on solving its own problems than on extension and demonstration for growers. The extension service in Xinkou town did not have much capacity as well and was mainly focussed on top-down transfer of technical knowledge. The project introduced participatory extension approaches, amongst others during the three weeks training in the Netherlands. This approach, however, appeared difficult to be introduced at project level, because of the limited technical knowledge of the staff of TADC and Xinkou town with respect to growing (Dutch) vegetables in greenhouses. For that reason it has been decided after the first evaluation to focus the project extension activities on improving the technical and economic results at TADC and the other project locations instead on developing a complete extension curriculum.

Important in that respect were the visits to the research and demonstration facilities of Rijk Zwaan in Qingdao and Shouguang and the training and extension activities of Rijk Zwaan at TADC and the other project locations. A regular working/advising relation has been established.
In the course of the project TADC staff started to intensify its extension activities along side its commercial activities. The centre provided advice to growers who belonged to their network of suppliers, amongst others via the "Tianjin Country Special Technological Confraternity" (CSTC). Via this association TADC can disseminate information on new technologies to all towns and villages in the municipality of Tianjin. Information meetings have been organised and training material has been prepared: articles on Dutch vegetables in a weekly Magazine on Science and Technology and brochures/leaflets with cultivation guidelines for the different crops are in preparation. The Dutch project team advised TADC on the development of extension material for growers.
TADC became also increasingly known as an interesting demonstration site. Thousands of interested people, varying from young school children towards high-level officials visited the centre to see the new technologies, amongst others during the "Tianjin Popularity Week of Science and Technology" in May 2002. For that purpose the centre has improved its demonstration facilities.

Fig 3.5 Participatory extension approach; TADC and Dang Cheng

Major Conclusions
Based on the project experience it can be concluded that the knowledge and information system in Tianjin with respect to vegetable growing can be improved a lot. At one side the specific knowledge with respect to vegetable growing should be deepened, while at the other side the available knowledge should be shared more broadly. For deepening the knowledge different possibilities are available, like reading professional literature, meetings with other experts, courses and conferences. In particular the junior staff at TADC should get practical training at demonstration sites or growers who have good results in growing (Dutch) vegetables in greenhouses. In a latter stage the accumulated knowledge can be extended to the growers in the region in different ways, via visits of TADC staff to growers and visits of growers to TADC, supported by practical extension material, e.g. guidelines on good agricultural practices.

TADC does not yet have a well-structured extension and demonstration system; the centre did not yet clearly determine and balance its demonstration and production functions. Most of the activities show an ad-hoc approach. This situation reflects the problems the agricultural sector in Tianjin is facing at the moment. Apparently a clear strategy for agricultural development, including a clear view on the role and responsibilities of the different institutions at different levels in this development process, is not yet available. Such a plan is needed for the desired modernisation of the agricultural sector in Tianjin.

Lots of people are visiting TADC, partly for professional purposes. The project was not directly involved in the organisation of these visits, but the Dutch experts proposed some changes in the organisation of the visits and improvements of the demonstration facilities at TADC and the extension material. Part of the improvements has been implemented but further professionalisation is required to increase the effectiveness of the demonstration and extension functions of TADC.

3.5 Research

TADC did not have a research programme when the project started, except for simple comparisons of the technical results in the different greenhouses. The monitoring system introduced by the project was considered a useful tool, but also as a burden, because of the work load: taking samples of soil, water and vegetables, and the collection and entering of data noted by the growers. At the end of the project, however, the usefulness was clearly shown through the appalling results (see monitoring report).
The contribution of TAAS and TADC staff to the technical research in the project was limited to data collection and technical analyses of the samples. They did not contribute to the analysis and reporting on the monitoring. Research, however, is of vital importance for modernisation of the agricultural sector and if TAAS wishes to play a role in this process, it needs to strengthen its research capacities. TADC continues to monitor the developments in the greenhouses, in particular with respect to soil and water quality and the use of fertilisers and plant protection agents. An important incentive comes from the governmental policies at central and local level to enhance the development of safe and environmental friendly food production. The authorities expect TADC to play a central role in this respect, together with, for example, the Central Laboratory of TAAS. It is also expected that TAAS is going to pay more attention to research. A step in that direction is the research proposal that TAAS has submitted to the central government and is aiming at the introduction of food safety approaches in vegetables, rice and poultry production in Tianjin (Project title: "The Comprehensive Demonstration of the Application of Key Techniques of Safe Food Production in Tianjin")

Besides technical research the project had also economic research components, farm business and market research. It was the intention to base the farm business research on the data from the farm monitoring system, but during the project the focus shifted towards the technical aspects because of the disappointing technical results. Only a few financial data have been included in the farm monitoring report. The farm monitoring system provided also some data from the growers on the received market price, but there were hardly structured data available for comparison with markets in Tianjin and Beijing. For that reason the project introduced a system for monitoring market prices. The system is not yet operational but it is expected that TADC will establish such a system to strengthen its trading capacities.
In an early stage of the project it became obvious that the expertise with respect to economic research, including market research was very limited in Tianjin, not only at TADC and TAAS, but also at Nankai University and the Agricultural College. For that reason staff of LEI delivered lectures on market research. A consumer survey has been carried out to show the methodology as well as to get a better view on the actual situation with respect to consumer concerns in Tianjin. Students of the Tianjin Agricultural College held the interviews.
In addition to that the Dutch team carried out a survey to explore the export opportunities for Tianjin vegetable growers. The results of these studies have been presented at the marketing seminar and the final seminar, as well as at meetings at the Agricultural College and Nankai University. Both institutions showed great interest in strengthening the relations with Dutch agricultural education and research institutions.

Fig 3.6 Presentations at Nankai University and Agricultural College

Major conclusions

The general conclusion is that the research activities did not work out as it was anticipated, in particular because of lacking research expertise at the Chinese side. The major focus of TADC but also of the most other institutions under TAAS was on strengthening their commercial position and they were, therefore, less research oriented than it was expected at the start of the project. Other projects of Wageningen University in China show that the research capacity in Tianjin with respect to agriculture is very limited compared with other provinces, in particular in comparison with Beijing. For that reason the Dutch project partners decided to involve institutions form other provinces in the follow-up projects. The project, however, initiated also new research activities in Tianjin. TAAS submitted two research proposals for support to the central government and also the Nankai University took initiatives for future projects with Wageningen University. The project introduced new research topics and relevant methodologies in Tianjin and it is expected that on that basis new joint research activities will start soon.

4 CONCLUDING REMARKS

The dynamic development of the vegetable sector in Tianjin in the last decennia was mainly based on the available knowledge and expertise. The future will require more than that. New approaches and new technologies are needed to meet the requirements of the demanding consumer of the future and to cope with the increasing competition from other production regions in China and abroad. Adequate education, research and extension are required to give the growers, the traders, processors and retailers the required knowledge, skills and tools. That will be one of the major challenges for Tianjin, because the current knowledge infrastructure is insufficient, judged on the experiences during the project implementation.

The promotion of Pollution Free Vegetables needs a systematic approach. The project showed that it is not easy to develop a well functioning vegetable supply chain, given the current disjointed chain with multiple owners. There is limited information flow among growers, traders and retailers resulting in trial and error practices instead of systematic approaches in business development. This leads to poor market performance. The supermarkets in China do not yet play the leading role as they do in the developed countries, but it may be expected that they will take the lead sooner or later. Other actors in the chain like large traders may also take this leading position. In Tianjin the commercial subsidiary of TADC took the lead in developing a supply chain for PFV.
The establishment of well functioning supply chains in the agri-food sector will contribute to the development of the rural area of Tianjin and it is recommended that the government encourages these developments, not by taking the lead as a player in the market, but as a facilitator. It will be necessary to strengthen the legal and institutional framework of food quality control, in order to meet the often very strict requirements of importing countries. Certification, inspection, auditing and the enforcement of regulations need to be separated and carried out by different institutions, private or public. The government should take the lead and the responsibility to develop such a system.

The project did not succeed in mobilising adequate research capacity with respect to the different aspects of the vegetable supply chain. It was not possible to find researchers with the required expertise in technical and economic research. The impression is that the quality of agricultural research in Tianjin in general is lagging behind that in other regions, in particular in Beijing.
It will be necessary to strengthen the research capacity through changes in the curricula at the education institutions, co-operation with research institutions in China and abroad and exchange of staff and students. The Tianjin government could foster this development by supporting (applied) research programmes that are focussed on the problems of the rural area. For solving these complex problems multidisciplinary research is required, meaning that researchers from different disciplines and different institutions work together and share their results instead of individually working on parts of the problem, like it seems to be the custom at the moment.

The overall conclusion is that the project took initiatives in many fields, some of them with success but others still in an uncertain starting phase. It is recommended that the Tianjin agricultural sector proceeds along these lines of modernisation and innovation in order to tackle the growing socio-economic problems in the rural area. It is recommended to follow a participatory approach in which all stakeholders, including farmers, traders, retailers, research and governmental institutions, work together to solve short-term problems and to develop long-term strategies. Continuation of the newly established business and research relations with Dutch companies and research institutions can play a fruitful role in that modernisation process.

APPENDICES

APPENDIX 1. TRAINING PROGRAM IN THE NETHERLANDS IN MARCH 2001

Objectives and approach

The major goal of the training component in the project was to provide the Chinese experts in-depth knowledge on Good Agricultural Practices in vegetable production, client-oriented extension methods and systems for monitoring different aspects of sustainable vegetable production. Training courses took place both in the Netherlands and China. In the Netherlands the training courses were focussed on training of trainers, while in China the training courses were organised at the project locations. The training in the Netherlands, from March 16 till April 3, 2001, was organised around two groups, one group that was involved in vegetable cultivation and one group that was responsible for the implementation of the monitoring systems. In order to focus the training on the training-needs of the participants regularly plenary meetings were organised for evaluation and planning with representatives of the Dutch partners in the project. Plant Research International provided the monitoring training, IAC gave courses on extension systems development, and Rijk Zwaan trained on cultivation techniques and market development, while LEI contributed with lectures on marketing research and chain management. The training was also used for developing a joint working plan for following months.

Participants

The following Chinese experts participated in the training:

Name	Date	Institution	Position
Mr. Weimin Li	1945	TADC	Dpt. Managing director
Mr. Zhili Qiao	1958	Xinkou, Government	Vice president
Mr. ShaoHui Chen	1961	TADC	Dpt. director
Ms. Cheng Yi	1963	TAAS, Central Laboratory	Director
Mr. Renshun Zhao	1965	Xinkou, Station Technology	Director
Ms. Xiaoling Yang	1968	TADC	
Ms. Xuan Wang	1976	TADC	
Mr. Zhenshan Yang	1977	TADC	

Mrs. Cheng Yi and Mrs. Xiaoling Yang were responsible for the monitoring system in China and therefore trained at Plant Research International. The other six people followed extension training at IAC, in particular focussed on getting acquainted with different extension methods and setting up an extension program. This group had also training at Rijk Zwaan on different topics from cultivation techniques up to chain management.

Training programme

Day	Date	Organising Company	Group 1 Horticulture experts	Organising Company	Group 2 Research and monitoring
Fri	16 / 03	IAC/LEI	16.40 Arrival in Amsterdam, Travel to Wageningen		
Sat	17 / 03	IAC/LEI	Introductions on training programme, the Netherlands and Dutch Agriculture		
Sun	18 / 03	IAC/PRI	Documentation and literature		
Mon	19 / 03	IAC	Extension training: - Communication approaches - methods of participatory extension - planning of extension campaigns - monitoring of extension campaigns.	PRI	Monitoring systems training: - Quality standards - Control Systems - Sampling and analytical procedures
Tue	20 / 03				
Wed	21 / 03				
Thu	22 / 03				
Fri	23 / 03				
		ALL	Evaluation and planning workshop		
Sat	24 / 03	LEI	Round tour from Wageningen to Delft (after which group 1 moves to Delft)		
Sun	25 / 03		Sight seeing		
Mon	26 / 03	RZ	Training on cultivation techniques Introductions on chain management Visits to: - Vegetables growers - Experimental station Naaldwijk - Flower auction export company	PRI	Monitoring systems training: - Database design - Data analysis
Tue	27 / 03				
Wed	28 / 03				
Thu	29 / 03	RZ	Visits to vegetables growers and related companies (after that to hotel in the Hague)		
Fri	30 / 03	LEI	Introductions on market research and marketing Visits to flowerbreeding company, trade company and gardening centre		
Sat	31 / 03	LEI	Visit to large retail market and retailers in the Hague		
Sun	01 / 04	Chinese team	Sight seeing		
Ma	02 / 04	LEI	Introductions on market research and marketing		
Tue	03 / 04	All Chinese team	Concluding workshop 19.50 DEPARTURE to CHINA		

APPENDIX 2. AGRI-FOOD SUPPLY CHAIN SEMINAR, SEPTEMBER 2001

Programme of Seminar in Tianjin, September 20-21, 2001, Tianjin, China

Thursday, September 20

9.30	Welcome Mr. He Rong Lin, Vice-secretary General Tianjin Municipality Government
9.45 - 10.00	Tianjin Vegetable Supply Chain Project Mr. Ben Kamphuis, LEI, project manager
10.00 - 11.00	Global marketing Strategy, Ms. Xiaoyong Zhang, LEI, Market researcher
11.00 - 12.00	Supply Chain Management, Mr. George Zhang, Syngenta, Head of Marketing
12.00 - 13.30	Lunch
13.30 - 14.30	Quality control and certification, Mr. Michael Lam, Food SBU, SGS-CSTC, Deputy Director
14.30 - 15.30	New vegetables on the Chinese dish, Mr. Wenhu Li, Representative of Rijk Zwaan in China
15.30 - 16.00	TADC, marketing strategy, Mr. Liu Shu Ting, Marketing manager of TADC
16.30 - 16.30	Concluding discussion
16.30 - 17.30	Visiting facilities at TADC

Friday, September 21

9.30	Welcome
9.30 - 10.30	The role of the marketing manager, Mr. Peter Ravensbergen, LEI
10.30 - 11.30	Collecting and using market (price) information, Mr. Ben Kamphuis, LEI
11.30 - 12.15	How to do marketing research, Ms. Xiaoyong Zhang, LEI
12.15 - 12.30	Concluding discussion
12.30 - 13.30	Lunch
13.30 - 14.30	Presentation of market price information system and interview by Tianjin TV

APPENDIX 3. TIANJIN CONSUMER STUDY

Dr. Xiaoyong Zhang, "Tianjin consumer study; with special attention to food safety", LEI, The Hague, The Netherlands, 2003

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APPENDIX 4. TIANJIN MONITORING STUDY

Monforte, N. and W.J. Corré, "Development of sustainable vegetable production in Tianjin (China): report of a monitoring study". Plant Research International, Wageningen, The Netherlands, 2003

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APPENDIX 5. TRAINING PROGRAMME IN QINGDAO IN OCTOBER 2001

The first growing season in the Tianjin project showed that further training of the staff of the involved institutions is required. For that purpose Rijk Zwaan has organised a 3 days training course in Qingdao from 27 till 29th of October. In addition to staff of Rijk Zwaan three professors of China Agricultural University Beijing and one professor of Shenyang Agricultural University will contribute to the training.

PROGRAMME

26th October

16:00	Arrival and Registration of the participants.
18:00	Dinner

27th October

8:00	Opening speech by Mr. Wenhu Li
8:30 - 9:15	Mr. Wenhu Li Introduction of new varieties, vegetable market development of China, variety choice for start the season and key points for the sucess of growers.
9:15 - 10:00	Prof. Zhang Fuman Presentation on mini-cucumber cultivation techniques
10:00 - 10:15	Coffee/Thea break
10:15 - 11:00	Prof. Wang, Beijing Agricultural University Presentation on peppers cultivation techniques.
11:00 - 11:45	Prof Dr. Dingjun, Beijing Agricultural Uiniversity Disease control techniques on mini-cucumber
12:00 - 13:30	Lunch
14:00 - 14:45	Prof. Fen Hiu, Dr. director of Shenyang Agricultural University Tomato cultivation techniques
14:45 - 16:00	Dr. Dingjun, Dr.of plant protection of Beijing Agricultural University Disease control techniques on tomato and celery
16:00 - 17:00	Free discussion and questions
17:10 - 17:25	Presentation by Dr. Anton van Doornmalen, Director of Rijk Zwaan
18:00	Dinner

28th October

8:00 - 12:00	Departure to Rijk Zwaan Breeding station Qingdao; variety trials and crop management, guided by Dr. Yuan, Mr. Wang Mingjiang, Dr. Ding, Mr. Li Wenhu
12:00 - 13:30	Lunch
14:00 - 17:30	Discussion and guided tour on demonstration centre Qingdao.
18:00	Dinner

29th October

7:00	Departure to Shouguang
10:00	Arrival in Shouguang
10:00 - 12:00	Visit of Rijk Zwaan demonstration fields and market
12:00 - 13:30	Lunch
14:00 - 16:00	Visiting growers and discussions
16:00	Departure to Qingdao
19:00	End of the training

APPENDIX 6. AGRICULTURAL EXTENSION IN TIANJIN

Ben Kamphuis, Nol Verhaegh, Xiaoyong Zhang, 2003, "Agricultural Extension in China; Case Tianjin", LEI, The Hague, The Netherlands.

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APPENDIX 7. AGRICULTURAL MARKETING IN TIANJIN

Ben Kamphuis, Peter Ravensbergen, Xiaoyong Zhang, 2003, "Marketing of vegetables in China; Case study Tianjin", LEI, The Hague, The Netherlands.

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APPENDIX 8. TIANJIN CONCLUDING SEMINAR, SEPTEMBER, 2002

Background

Since autumn of the year 2000 organisations from the Netherlands and China work together in a project to strengthen research and extension on sustainable vegetable production and marketing in Tianjin. The Chinese partners in the project are Tianjin Academy of Agricultural Sciences (TAAS), in particular the Tianjin Agricultural Demonstration Centre for New and Advanced Technology (TADC), and vegetable growers and traders in Xinkou Town. The Dutch partners are research institutes of Wageningen University and Research Centre (Wageningen-UR) and Rijk Zwaan, a seed company. The project is financed by the Netherlands government. During the project Rijk Zwaan delivered to TADC seed of Dutch vegetable varieties and provided advice in growing techniques and marketing. Another Dutch company, Stolze, installed equipment for irrigation, fertilisation and climate control at TADC. The research institutes of Wageningen-UR set up a system to monitor on farm activities and marketing. In addition they provided assistance in different aspects of the vegetable chain via on the job training and seminars. The seminar was aimed at presenting and discussing the results of the project to the directly involved partners in the project and policy makers as well and to formulate a set of recommendations for strengthening the vegetable supply chain in Tianjin.

Target Groups

The seminar was focussed on two different target groups; first the directly involved and other interested growers and staff of TADC and other organisations, like extension services, and secondly staff of scientific and governmental institutions in Tianjin.

Agenda

The seminar covered two days (September 19 and 20). The first day was used for presenting and discussing the results of the project with growers, farm managers, horticultural experts and advisors in order to formulate practical advice for vegetable growing and marketing in Tianjin.
The second day was focussed on policy recommendations with respect to the vegetable sector in Tianjin. The project team presented the major results of the project and and possible strategies for improvement of the performance of the Tianjin vegetable supply chain.

Location

The growers' seminar was held at the Tianjin Agricultural Demonstration District for New and Advanced Technology, Tianjin and the Policy seminar in the Tianjin World Trade Centre in Tianjin

Involved organisations

The Dutch project partners are:
- Agricultural Economics Research Institute (LEI)
- Plant Research International (PRI)
- International Agricultural Centre (IAC)
- Rijk Zwaan BV
- Stolze Irigation BV

The major Chinese partners are:
- Tianjin Academy of Agricultural Sciences (TAAS)
- Tianjin Agricultural Demonstration Centre for New and Advanced Technology (TADC)
- Vegetable and Fruit Service Company of Xinkou Town
- Growers at Liu Fu and DangCheng

Programme

Wednesday, September 18, 2002

11:30	Arrival of foreign guests in Beijing and transport to Tianjin
19:00	Dinner

Thursday, September 19, 2002, Growers seminar

8:30	Arrival and registration Welcome by the chairman of the seminar Mr. LongQing WANG, Vice president TAAS
9:00 - 9:15	Introduction to the project Mr.Ben KAMPHUIS, LEI
9:15 - 10:00	Performance of Tianjin growers Wim CORRÉ, PRI
10:00 - 10:30	Growers' experiences with Dutch varieties Mr. TianLi GAO, Grower of Dang Cheng village
10:30 - 11:00	Solutions for cultivation problems Mr. Gerard HULISZ and Mr. Jun DING, Rijk Zwaan
11:00 - 11:15	Break
11:15 - 11:45	TADC in the market, results in the past, plans for the future Mr. ShuTing LIU, Manager Nong Peng Co. Ltd.
11:45 - 12:15	Opportunities for Export Mr. Wenhu LI, Rijk Zwaan
12:15 - 13:15	Lunch
13:15 - 13:45	Developments in the Chinese vegetable markets Mr. Wenhu LI, Rijk Zwaan
13:45 - 14:15	Pollution Free Production Action Plan Mr. ShouLiang Shi, Tianjin Pollution Free Vegetable Office
14:15 - 14.45	Environmently friendly production in Tianjin Mr. Weimin LI , TADC
14:45 - 15:00	Closing Prof. Longqing WANG, Vice president of TAAS
18:30 - 20:00	Banquet for Dutch Guests at GouBuLi Restaurant

Friday, September 20, 2002, Policy Seminar

8:30	Arrival and Registration
9:00 - 9:15	Welcome by the chairman of the seminar Prof KaiXuan LU, President of TAAS
9:15 - 9:30	Introduction to the project Ben KAMPHUIS, LEI
9:30 - 10:00	China vegetable export and food safety issues Requirements of domestic and foreign markets Dr. XiaoYong ZHANG, LEI
10:00 - 10:45	Monitoring for quality insurance in vegetable growing Results and policy recommendations Mr. Wim CORRÉ, PRI
10:45 - 11:15	Break
11:15 - 12:00	Knowledge transfer from research to growers Mr. Nol VERHAEGH, LEI
12:00 - 13:30	Lunch
13:30 - 14:00	Food and trade policy of the Chinese government Mr. Jinsong CHEN,CASS, Beijing
14:00 - 14:30	Vegetable Supply Chain in practice Mr. Jan DOLDERSUM, Rijk Zwaan
14:30 - 15:00	Food Certification in China Mr. Harry WONG, SGS, Tianjin
15:00 - 15:30	Challenges for TADC in the future Mr. ShaoHui CHEN, TADC
15:30 - 15:45	Sino-Dutch relations Mr. Rubert KONIJN, Netherlands Embassy
15:45 - 1600	Impressions of the Steering committee Mr. Jaap POST, LEI
16:00	Summary and Closing Prof KaiXuan LU, President of TAAS
18:00	Banquet