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Development of sustainable vegetable production in Tianjin (China): report of a monitoring study

N. Monforte Duart & W.J. Corré

Report 55

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Summary

This report deals with the vegetable production system in greenhouses of Tianjin (Northeast China) under the coverage of a collaboration project between Chinese and Dutch commercial and research parties. Partners in this project were the Wageningen University and Research Centre partners IAC, LEI and Plant Research International , and Rijk Zwaan B.V. and Stolze B.V. from the Netherlands and the Tianjin Academy of Agricultural Science, the Tianjin Agricultural Demonstration Centre and its marketing organisation the Nonpeng Agricultural Development Co. Ltd. and the Xinkou Vegetables and Fruit Service Co. from China.

The aim of this report is to contribute to the development of a sustainable vegetable production system for small-scale greenhouses in Tianjin. For this purpose a monitoring study was set up, in which data on inputs and outputs of greenhouse crops were collected and analysed. This monitoring study was established during three consecutive planting seasons: spring and autumn planting season 2001 and spring planting season 2002. The project focussed on the production of cucumber, tomato, sweet pepper and eggplant, and Dutch varieties of these crops were introduced in Tianjin in the project.

The introduction of Dutch varieties of tomatoes, cherry tomatoes and mini-cucumber can be considered as successful in general. Eggplant and pepper, however, did not show satisfactory yields and had no successful market in the Tianjin area. However, also in the production of tomatoes and cucumber the technical knowledge about cultivation could still be improved and better yields are possible. Dutch tomato and mini-cucumber varieties can be valuable crops in future Chinese vegetable production.

Monitoring the production process on input and output gave much information on management practices. Too large inputs of water, pesticides and nutrients were found. Furthermore, farmers still hardly apply any guidelines for greenhouse management practices and generally use much more inputs than necessary. Farmers make use of strongly variable input amounts, including variable timing and number of applications of water and nitrogen to grow the crops, with no measurable effect on production. Farmers clearly need more experience and explicit guidelines for general crop management and use of inputs to reach or maintain profitable production levels with a lower and more efficient use of inputs. Standard on-farm monitoring of yields and inputs and regular analysis of the soil nutrient status are important and helpful management tools to improve efficiency. A more efficient use of inputs will be beneficial for both economic and environmental reasons.

This study demonstrates that there are many opportunities for improvements regarding costs and environmental effects. More efficient use of nutrients and water can be reached by introducing guidelines and new techniques such as, e.g., drip irrigation. More research is needed to develop clear and solid-based recommendations

Further development of the Tianjin vegetable production requires access to new markets, within China and abroad, for which a guaranteed food quality and safety is a prerequisite, and the establishment of a routine control system is inevitable.

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1. Introduction

The work presented in this report is a product of a two-year co-operation between the Netherlands and China (from November 2000 until October 2002) on investigation and control of the vegetable production and marketing in Tianjin, China. For this project, entitled 'Tianjin Vegetable Supply Chain', a consortium has been established of both Chinese and Dutch research institutions and private companies. The major Chinese partners are representatives from the Tianjin Academy of Agricultural Sciences, the Tianjin Agricultural Demonstration Centre for new and advanced Technology (TADC) an the Xinkou Vegetable and Fruit Service Company. TADC is a subsidiary of TAAS. The Dutch partners in the consortium are the Agricultural Economics Research Institute (LEI), Plant Research International, the International Agricultural Centre (IAC), Rijk Zwaan B.V. and Stolze B.V. The organisations in the consortium formed for this project have long-term experience in the field of research and extension in agriculture and provide the required knowledge and skills as well as the required technologies. The project was financially supported by the Asia Facility of the Dutch Ministry of Foreign Affairs (Senter project nr. AF00/1/CH/17).

The results of a monitoring study of vegetable production in greenhouses are analysed in this report. The objective of this study was to improve the sustainability of vegetable production on aspects of economy, food safety and environment. In the study the production of four major vegetable crops (cucumber, tomato, pepper and eggplant) was monitored in plastic greenhouses.

The monitoring study was a co-operative activity of Dang Chen and Liu Fu vegetable growers, Xinkou Town (extension service) staff, TADC staff, TAAS Central Laboratory Staff, and Plant Research International. We gratefully acknowledge the contribution of all partners.

2. Project background

The study area of this project is situated in Tianjin, 150 km Southeast of Beijing. Tianjin (the fourth largest city of China) serves as an important grain and vegetable production base for the Tianjin-Beijing area and it is a major industrial city in Northeast China. Furthermore, Tianjin is the second largest harbour city of China (next to Shanghai), which creates a perfect opportunity to export vegetables to the Southeast Asian markets (including Japan).

However, currently the production of vegetables is still largely focused on volume production, with a low priority for product quality and marketing, while the external conditions have drastically changed over recent years. The fast economic growth in China has increased the demand for vegetables, while at the same time increasing the importance of quality. Since the vegetable growing area in China has increased threefold over the period 1982-1998 (Jin, 2001), Chinese horticulture faces an overproduction of vegetables of medium and low quality, while the market for vegetables of guaranteed good quality is still good. Export could be an adequate answer to overproduction, but especially access to the export market requires a permanent guaranteed good quality. Furthermore, the focus on production volume has led to high and inefficient use of fertilisers, water and pesticides. Inefficient fertiliser use contributes to water pollution and water of good quality is already scarce in Northeast China. Inadequate pesticides use has led to health hazards in the past and is an important barrier for export. Horticulture in the Tianjin area now meets the challenge of the need for intensification (to guarantee good quality and sufficient revenues) and for improved efficiency of nutrient and water use (to guarantee environmental sustainability) at the same time.

Vegetable production in Tianjin is mainly based on small size, single-household units. The relative closeness of Tianjin City and Beijing offers big market outlet opportunities for the Tianjin growers. The producers, however, are still insufficiently consumer-oriented. It is difficult for the vegetable growers to change the situation because they mostly lack experience with modern vegetable crops and production methods, while explicit guidelines for crop production under local conditions are not available. Furthermore, they have limited access to improved technology like new variety seeds and modern production facilities. The Tianjin Municipality Government is therefore supporting the development of modern client-oriented agricultural support services. The Tianjin Academy of Agricultural Sciences (TAAS) plays an important pioneering role in this field.

Through re-orienting its research, training and extension activities, the TAAS tries to reach the small vegetable growers and to introduce and foster sustainable vegetable production that meets consumer demands on the local, the national and the international market.

3. The current situation of agriculture in China

China is a major player in global production and consumption, and it has experienced one of the fastest rates of agricultural and overall economic growth. China's population of more than one thousand million depends directly upon agriculture for subsistence (Smit & Yunlong, 1996). Agriculture has played an important role in poverty reduction in China and the development towards a market-led economy has substantially stimulated vegetable production. The Chinese agricultural sector is making substantial progress.

The increased population density and rapid modernisation of the Chinese society imposed new challenges for Chinese farmers to ensure an adequate food supply for the growing population by producing more food from increasingly marginal land with the introduction of new inputs (chemical fertilisers and pesticides) (Kuangfei *et al.*, 1999).

A harmful 'collateral damage' of China's rapid industrial development since the 1980s has been the increased and still increasing pollution of soil, water and air. The Chinese government recognises that the environmental situation in China is grim and that increasing water and air pollution, as well as deforestation and desertification, will threaten the base of China's economic development. An increase in the food requirements of an increasing population and the decrease in land resources in China will cause agriculture to intensify in the future and pollution will be a serious problem in China for the years to come.

The intensive production involves large inputs of water and nutrients, especially of nitrogen. Since the 1980's, nitrogen fertiliser consumption in China has increased substantially (Zhang *et al.*, 1996). The present level of chemical fertilisation in China is considerably higher than that normally applied in Western countries. For example, in the province of Hubei in China, the use of N-P-K chemical fertilisers increased, from about 300 kg/ha in 1980 to about 850 kg/ha in 1990 (Kuangfei *et al.*, 1999) while the use of chemical fertilisers in USA (also in 1990) was about 100 kg/ha and in Spain around 300 kg/ha. In high-yielding crop regions of northern China, N-fertiliser application is usually over 500 kg/ha per year with an accompanying decrease in utilisation efficiency. High nitrogen application rates do increase potential groundwater N-pollution, while many groundwater resources in North China already have a high nitrate content (Zhang *et al.*, 1996).

China's agriculture has to keep expanding to feed it's huge population but water endowment is very poor (Jin, 2001). Water is fast becoming an economically scarce resource in many areas of the world (Chartzoulakis & Drosos, 1994). Depletion of water supplies is a big problem, particularly in northern China. The annual run-off of the Songua River Basin in north-east China decreased about 70% between 1960 and 1980 (Smit & Yunlong, 1996). Thus, there is a clear need to induce farmers to use water more efficiently in northern China. Furthermore, farmers still hardly have any guidelines for irrigation practices and generally do use much more irrigation water than necessary. They use strongly variable amounts of water and nitrogen to grow the crops, with no measurable effect on production. The concern of keeping the water reserves of good quality forces also to minimise the nitrogen input in agriculture, while maintaining the production at high level.

The integration of agriculture and rural development and the focus on dealing with the quantity and quality of agricultural products and the living levels of farmers are very important for a sustainable development of China.

Currently, China's horticulture faces multiple challenges of the increasing demand for high quality vegetables (by intensification of the production and meeting pollution-free standards) due to increasing public awareness with respect to health and environment. At the same time the overproduction of low quality vegetables has already led to low market prices for some vegetable crops (e.g. tomatoes). This means that vegetable growers must succeed at the short term in a more efficient production of good marketable products to avoid losing the sustainability of their existence as vegetable growers.

4. Objectives of the monitoring study

The general objective of the 'Tianjin Vegetable Supply Chain' project is to contribute to the development of sustainable vegetable production (by small growers) and marketing in Tianjin. This should be achieved by improving crop and farm management and cultivation and marketing techniques. This initiative was linked to the promotion of 'pollution free vegetables' by the Chinese Government. The long-term goal of the project is to stimulate the use of sustainable production methods in vegetable growing in Tianjin in order to provide consumers in Tianjin with safe products of a good quality for a reasonable price and to improve the opportunities for export. The monitoring study concentrates on aspects of environment (nutrient losses, water use efficiency), food safety (pesticide residues) and economy (profitable production).

The specific goals of the monitoring study are:

a) Collect information on vegetable production in the Tianjin area.
b) Create awareness of the importance of effective, efficient, and safe use of inputs and the importance of monitoring as a management tool.
c) Make comparisons of cropping techniques and crop varieties.
d) Detect opportunities to improve vegetable production on aspects of economy, food safety and environment by:
    - improved techniques and management practices in the greenhouses;
    - safe and efficient use of inputs for environmental and health benefits;
    - improved choice of varieties, product quality and yields.

In short, the monitoring study involved the monitoring of inputs of fertilisers (N, P and K), irrigation water and pesticides, outputs of products and quality of products (pesticide residues, nitrate content and nutritive components), soil and water. Details on the monitoring programme are given in Chapter 5.4.

5. Materials and methods

5.1 Location

The monitoring study was executed in Tianjin in the north-eastern part of the North China Great Plain. The studied sites are located in the Xiqing district, west and southwest of the Tianjin urban area. The geographic co-ordinates of the location are approximately 39 degrees North and 117 degrees East.

In this area vegetable production in greenhouses was monitored at three sites:
1. Tianjin Agricultural Demonstration Centre (TADC)
2. Liu Fu (village in the region of Xinkou Town)
3. Dang Chen (village in the region of Xinkou Town)

TADC is government-owned, but financially operates as a private company. In Liu Fu the greenhouses were under central management, controlled by the municipality that invested in the greenhouses and private farmers who owned the land. However, in spring 2002 management was taken over by independent small growers. In Dang Chen, management was the responsibility of a number of independent small growers. At TADC the greenhouses were built in 1999 and 2000, in Liu Fu in 1999 and 2001, and in Dang Chen in 2001.

5.2 Soil and climate

The **climate** in Tianjin is warm, semi-dry to humid and monsoon with typical features of the warm temperature zones. The average temperature in January is 1° C high and –8° C low, the average temperature in July is 31° C high and 23° C low. Annual rainfall is on average 560 mm, 80% of which falls between June and September.

Due to the cold winter and hot summer, usually two crops are grown each year, one from late winter until summer and another from late summer until winter. In arable fields traditionally irrigated winter wheat is grown from November until June, followed by rain-fed maize from June until September/October. In horticulture a wide variety of crops is grown. In winter many crops are protected with plastic against the cold wind.

The type of **soil** in the Xiqing district is a heavy clay. All analysed soils were alkaline, pH between 8 and 8.3 in TADC and between 7.5 and 8.3 in Dang Chen and Liu Fu, and had high salt contents, with EC values mostly between 0.3 and 1.0 ms cm^{-1} (Appendix IV, Table 4.1). The land has already for a long time been in use as arable land, with a low content of organic matter as a result. The contents of available P and K are generally good to high. The groundwater table is mostly between 1 and 2 meters deep.

The results of the general soil analysis at the three sites at the start of the project are shown in Table 4.1 of Appendix IV.

5.3 Materials

A total number of 80 greenhouses was included in the project. Most of them were traditional Chinese type greenhouses or so-called 'sunlight greenhouses', except two larger plastic ones. Chinese 'sunlight' greenhouses are simple and improvised, involving a long thick wall on the northern side and a plastic dome on the southern side. The wall is usually circa 3 meters high and 50 to 80 meters long, the dome is mostly circa 7 to 8 meters wide. The wall on the north side keeps the cold north wind out of the greenhouse and can contribute to a higher night temperature by storing sunlight energy. The simplest walls are made of clay, but in recent years mostly 20 cm bricks and sometimes polyester materials are used. As long as frost is possible, roughly from November to April, the plastic is covered with mats during the night to keep out the cold. These mats lie rolled up on the plastic domes during the day, where they can block a considerable proportion of sunlight. The area of a greenhouse is generally 1 Chinese mu or 667 m^2 (15 mu = 1 ha) gross area with a planting area of 550 to 600 m^2. The larger plastic greenhouses do not have a protecting wall and can not be covered during the night.

There are big differences in construction and materials used for the greenhouses. TADC has 14 sunlight greenhouses with a brick wall, 10 sunlight greenhouses with a polyester wall and 1 larger complete plastic greenhouse. Most of the greenhouses have mechanical systems for rolling the mats, four are connected to a central heating system and some more have coal burners. Liu Fu and Dang Chen also have sunlight greenhouses with a brick wall and with a wall of polyester, and one larger plastic greenhouse (only in Liu Fu); these greenhouses have no heating.

The spring season starts with planting from the end of February to the end of March, depending on the cold-resistance of the crop, and ends when the temperature becomes too high for normal growth in July or August, depending on crop and weather. The late season is mostly used for growing crops like tomato and cucumber until the winter, or for growing cold-resistant crops like celery until mid winter or early spring. Tomato and cucumber are planted in the end of August or in September, as soon as the summer heat ceases. The use of heating during winter to grow tomato and cucumber is doubtful, heating energy is expensive and the yields obtained are still low. Furthermore, with a good management it is possible to grow cucumber and tomato in sunlight greenhouses in this region in winter without heating.

Temperature and humidity in the greenhouses vary significantly due to all the different types of greenhouses monitored and differences in management. Humidity levels in the colder season are often high due to the scarce ventilation.

Different irrigation water sources are used. TADC and Liu Fu only use well water, in Dang Chen well water is only used when the level of the river water becomes too low.

In the project two Dutch commercial companies are introducing new **varieties** and **techniques** in China. Rijk Zwaan provided **seed** material (shown in Table 2, 3 and 4) for varieties of cucumber (*Cucumis sativus* L.), sweet pepper (*Capsicum annum* L.), tomato (*Lycopersicum esculentum* L.) and eggplant (*Solanum melongena* L.). Stolze supplied **equipment**, installing Dutch irrigation and fertilisation systems in TADC for two greenhouses and a climate control system for one greenhouse.

The irrigation system in these two greenhouses at TADC is a drip irrigation system with fertigation, but in all other greenhouses flooding irrigation with solid fertiliser application is used.
Pictures 1-3 show some examples of the greenhouse situation.

5.4 Monitoring programme

The monitoring programme consists of two components:

a) Farm bookkeeping: the farmers were requested to record the daily activities (like soil cultivation, planting, watering, etc.), including the use of inputs and the amount of harvested product and its market price. Recorded inputs were nutrients, water, pesticides, labour and energy. Since no water meters were present in the greenhouses, water input was recorded by the duration of water use, but because of pressure differences with time, the relation between time and amount of water input appeared to be poor. Labour input was not recorded in a reliable way, mostly the farmers objective seemed to be the division of the total day between activities and not the recording of real time needed for the activities. Energy input was of minor importance, only small machinery for soil cultivation and water pumps for irrigation were used. Differences in energy use between greenhouses were only due to different water inputs and were no longer analysed nor recorded after the first growing season. The farmers in Dang Chen and Liu Fu recorded the activities in the greenhouses in co-operation with the extension officer of Xinkou Town. A database structure was designed and implemented for the bookkeeping. Nevertheless, some data were not entered (Table 1).

b) Chemical analyses of soil, water and products: the complete monitoring programme includes analysis of soil, products, crop residues, irrigation water, groundwater and making a nutrient balance for N, P and K. Complete monitoring was only performed in a limited number of greenhouses; all results are shown in Appendix 4.

   Soils were analysed for mineral nitrogen (NH_4-N and NO_3-N), total nitrogen, pH, EC, Available P and K and heavy metals (As, Cd, Cr, Hg, Pb).

   Irrigation water and groundwater were analysed for nitrate, pH and EC.

   Products (fruits) were analysed for dry matter content, vitamin C, sugar, nitrate, total N, P and K and pesticide residues (malathion, parathion, phorate, methamidophos, monocrotophos, carbofuran and aldicarp in all four crops and deltamethrin, cypermethrin, fenvalerate, fenpropathrin, BCH and DDT in tomato, pepper and cucumber).

   Crop residues were analysed for total N, P and K.

   All analyses were performed according to standard procedures at the Central Laboratory of TAAS, except for the pesticide residues, which were analysed at the Plant Protection Institute of TAAS.

Table 1. Measurements realised in the monitoring programme for the three different seasons. Data: 1 = data collected; 0 = data not collected; 2 = data only collected in specific cases.

		Spring 2001			Autumn 2001	Spring 2002		
		TADC	L.F.	D.C.	TADC	TADC	L.F.	D.C.
CROP								
Production (kg)		1	1	1	1	1	1	1
Products: 1st class		1	0	0	1	1	0	0
Product quality	At the middle of harvest period	1	1	1	0	1[1]	0	0
	At the end of harvest period	1	1	1	0	1[1]	0	0
Crop residues	At the middle of growth period	2[2]	0[2]	0[2]	0	2[2]	0	0
	At the end of growth period	2[2]	2[2]	2[2]	0	2[2]	0	0
SOIL AND WATER								
Soil complete	At the start of growth period	1	1	1	0	0	0	0
Soil N-min	At the start of growth period	1	1	1	0	1	0	0
	At the end of growth period	1	0	0	0	1	2	2
Irrigation water	At the start of growth period	1	1	1	0	0	0	0
Groundwater	At the start of growth period					2	0	0
	At the end of growth period					2	0	2
INPUTS								
Irrigation (mm)		1	1	1	0	1	0	0
Fertilisation (kg/ha)		1	1	1	1	1	1	1
Pesticides (kg/ha)		1	1	1	1	1	1	1

[1] *only nitrate and total N*

[2] *dry matter content was not recorded*

5.5 Spring planting season 2001

During the **spring season 2001,** the following number of greenhouses were monitored:
- TADC 12 greenhouses (8.15 mu or 5 436 m^2)
- Liu Fu 34 greenhouses (30.25 mu or 20 177 m^2)
- Dang Chen 34 greenhouses (28.1 mu or 18 736 m^2)

In total, 80 greenhouses were monitored with a total area of 66.7 mu (or 44489 m^2).

The species and varieties monitored on each site are shown in Table 2.

Tomato was the most important crop with 35% of the total area, while cucumber was the least important crop of the three sites with 12% of the total area.

The Dutch seed material was delivered just in time for the growing season, but part of the seedlings could not be transplanted in time, since a number of greenhouses were newly build and not ready in time. All planted varieties were Dutch varieties except one Chinese variety of cucumber called Chun.

Planting and harvest dates, and the number of plants planted per square metre are shown in the appendixes.

Table 2. Crop varieties and number of greenhouses monitored at three sites during the spring planting season 2001.

Species	Variety	Number of greenhouses in TADC	Number of greenhouses in Liu Fu	Number of greenhouses in Dang Chen
Tomato	Beril	2	7	7
	73-33 (Katerina)	2	1	5
	72-68 (cherry)		1	
Cucumber	Deltastar mini	1	5	3
	Chun (Chinese)			2
Pepper	Salvita	1	3	1.5
	Sirtaki	2	1	6
	Nassau	1	1	0.5
	Polka	1	3	1
	Niva	1	2	
Eggplant	Andrea	0.5	5	3
	Longo	0.5	5	5
Total		12	34	34

5.6 Autumn planting season 2001

During the autumn planting season, monitoring was carried out only at TADC in eight greenhouses. The total area monitored was only 3739 m² and cucumber was the main crop (with 38% of the total area). The varieties planted were mainly Dutch varieties, except two Chinese varieties of cucumber, one Chinese variety of pepper and two eggplant varieties (Table 3).

Cucumber was harvested until February, while tomato, pepper and eggplant were continued in the spring season and harvested until August.

In August 2001, Rijk Zwaan delivered seed for the autumn/winter season.

TADC has a heating system in some of the greenhouses and Dutch seed material can therefore be used. The planting schedule in the autumn/winter season depends, amongst other things, on the availability of a heating system. However, some farmers in this region in China do grow cucumber and tomato in sunlight greenhouses all winter without heating.

The growers in Liu Fu and Dang Cheng grew celery, sweet melons, long beans and spicy peppers in the autumn.

Table 3. Crop varieties and number of greenhouses monitored at TADC during the autumn planting season 2001.

Species	Variety	Number of greenhouses
Cucumber	22-72	3
	Chinese traditional	
	Chinese mini	
Tomato	Beril	2
	Melvin	
	Jinan	
	72-68	
Pepper	Niva	2
	Nassau	
	Salvita	
	Leila	
	Sirtaki	
	Chinese traditional	
Eggplant	Andrea	1
	Chinese green	
	Chinese traditional	
Total		8

5.7 Spring planting season 2002

For the spring planting season 2002, Chinese growers decided to enlarge the area of mini-cucumber in particular due to the good results attained during last spring season. 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. However, due to the unsatisfactory production and market of eggplant and sweet pepper during 2001, only mini-cucumber and tomato varieties were planted and monitored in the spring planting season 2002. The varieties planted were also mainly Dutch varieties, except three Chinese varieties of cucumber (090 and 126) and one variety from an American company (Muge) (Table 4).

In total, 46 greenhouses were monitored:
- TADC: 5 greenhouses (3.7 mu or 2440 m^2)
- Liu Fu: 13 greenhouses (13 mu or 8908 m^2)
- Dang Chen: 27 greenhouses (22 mu or 14664 m^2)

In March 2002 Stolze installed the new equipment at TADC, i.e. equipment for fertigation, in two greenhouses (A2 and A3) and for ventilation in one, including a process computer and instruments for weather measurement and recording. The monitoring in TADC during this season was focused on the impact of the newly introduced techniques, and it was oriented on the most profitable crop, the mini-cucumber.

Four greenhouses were monitored intensively (A2, A3, A4 and A11), all with the Dutch mini cucumber variety Deltastar and a minor part with a Chinese variety. The intention was to follow the completest monitoring programme possible for at least Deltastar.

In Liu Fu and Dang Chen Dutch varieties of both mini-cucumber and tomato were planted. Here only inputs of fertilisers and pesticides and outputs of products were monitored.

Table 4. Crop varieties and number of greenhouses monitored at three sites during the spring planting season 2002.

Species		Number of greenhouses in TADC	Number of greenhouses in Liu Fu	Number of greenhouses in Dang Chen
Cucumber	090	1		
	126			
	Muge			
	Chinese (Jin)	4		
	Deltastar mini	4	5	8
	Radiant		1	1
	Condesa		1	4
	22-21		1	1
Tomato	Beril		1	10
	Jinan		2	2
	Melvin		2	1
Total		5	13	27

6. Results and discussion

6.1 Results of the data analysis on the spring planting season 2001

Based on the yields attained, summarised in Table 5, the introduction of Dutch varieties of tomatoes, cherry tomatoes and mini-cucumber for the spring season 2001 can be considered as satisfactory in general. Eggplant and pepper, however, did not have good yields and were not successful on the local market. Cucumber and tomato crops obtained the highest yields.

Table 5. Yields and inputs; minimum and maximum values, standard deviation and averages per variety and per location during the spring planting season 2001.

		Yield (kg/m²)				Water (mm)								Pesticides (kg/ha)			
	EGGPLANT	min.	max.	st. dev.	aver.	min.	max.	st. d	aver.	min.	max.	st. dev	aver.	min.	max.	st. dev	aver.
Dang C	Longo	1.2	1.8	4.1	1.5	435	461	18.0	448	0.02	0.10	0.06	0.06	0	227	161.0	114
	Andrea	1.7	2.0	1.4	1.9	268	461	97.8	373	0.01	4.08	2.34	1.38	136	227	45.7	187
TADC	Longo		1.6	0.0	1.6		475	0	475		0.47	0	0.47		395	0	395
	Andrea		2.1	0.0	2.1		475	0	475		0.47	0	0.47		395	0	395
Liu Fu	Longo	0.5	1.0	2.4	0.8			0	814				0.00			0	845
	Andrea	0.5	0.7	0.6	0.6	781	1042	134.5	955	0		0	0.00	811	1081	139.6	991
	TOMATO	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.
Dang C	Beril	3.3	4.5	4.15	3.7	269	440	60.8	322	0.40	6.00	2.52	3.10	0	293	117.4	110
	73-33	3.5	3.8	1.48	3.6	243	320	34.3	297	0.40	6.60	1.96	2.09	0	233	91.6	118
Cherry	72-68 + Beril	3.5	4.5	7.48	4	352	440	0.0	320		6.60	0.00	6.61		41	0.0	41
TADC	Beril	4.5	5	3.54	4.8	250	325	54.1	289	3.20	8.40	3.68	5.83	178	674	701.9	426
	73-33	4.6	5	2.6	4.8	285	350	106.1	317	5.30	6.70	1.93	5.99	172	260	379.4	216
Liu Fu	Beril	4.5	6.3	7.59	5.5	1298	1442	77.1	1380	0.96	2.98	0.68	1.83				
	73-33 Katerina		3.2	0	3.2		768	0.0	768		0.56	0	0.56				
	72-68		3.6	0	3.6		577	0.0	577		1.35	0	1.35				
	PEPPER	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.
Dang C	Polka	0	0.2	0	0.2		234	0.0	234		0.02	0.00	0.02	0		0	0
	Sirtaki	0.2	0.4	0.9	0.2	192	282	40.0	229	0.02	0.06	0.02	0.03	0	79	39.0	32
	Salvita	0.3	0.7	2.2	0.5	359	423	45.3	391	0.02	0.10	0.05	0.06	0	79	56.0	39
TADC	Polka		1.5	0.0	1.5		555	0.0	555		3.49	0	3.49		75	0.0	75
	Sirtaki	1	1.2	1.1	1.1	95	196	56.7	136	0.00	1.17	0.83	0.59	90	196	149.9	36
	Salvita		0.7	0	0.7		365	0	365		0.91	0	0.91		47	0	47
	Niva		2.4	0	2.4		675	0	675		0.38	0	0.38		61	0	61
	Nassau		2.4	0	2.4		412	0	412		0.60	0	0.60		62	0	62
Liu Fu	Sirtaki				0.7				814				0.00				845
	CUCUMBER	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.	min.	max.	st. dev.	aver.
Dang C	Chinese		4.1	0	4.1		670	0	670		4.86	0	4.86		160	0	160
	Deltastar	3.4	4.7	5.4	4	194	908	299.4	562	2.70	33.50	13.93	12.90	0	819	371.9	396
TADC	Deltastar		4.9	0.0	4.9		466	0	466		2.02	0	2.02		476	0	496
Liu Fu	Deltastar	2	2.8	3.2	2.4	1490	1923	157.3	1721	7.40	10.50	1.15	9.33	742	1064	129.3	924

On the whole, the technical results of the tomato and cucumber crops were satisfactory taking into account that this was the first time that Dutch varieties were grown and the late start of the

transplanting. However, during the various missions the Dutch visitors observed bad practices, e.g. with respect to temperature, ventilation and light control, disease control, watering, topping and pruning. Apparently, growers were insufficiently experienced in greenhouse and crop management.

Tomato was the maincrop during the spring planting season 2001. Three different tomato varieties were grown to study and determine the efficiency in input utilisation and fruit yield. Different varieties can show differences in input utilisation and in obtained yields.

The average tomato yields in Liu Fus were between 3.2 kg m^{-2} ('73-33' variety) and 5.5 kg m^{-2} ('Beril' variety). However, the higher yield obtained for the 'Beril' variety was not statistically significant (Figure 1) and 'Beril' and '73-33' varieties achieved similar yields in both Dang Chen and TADC.

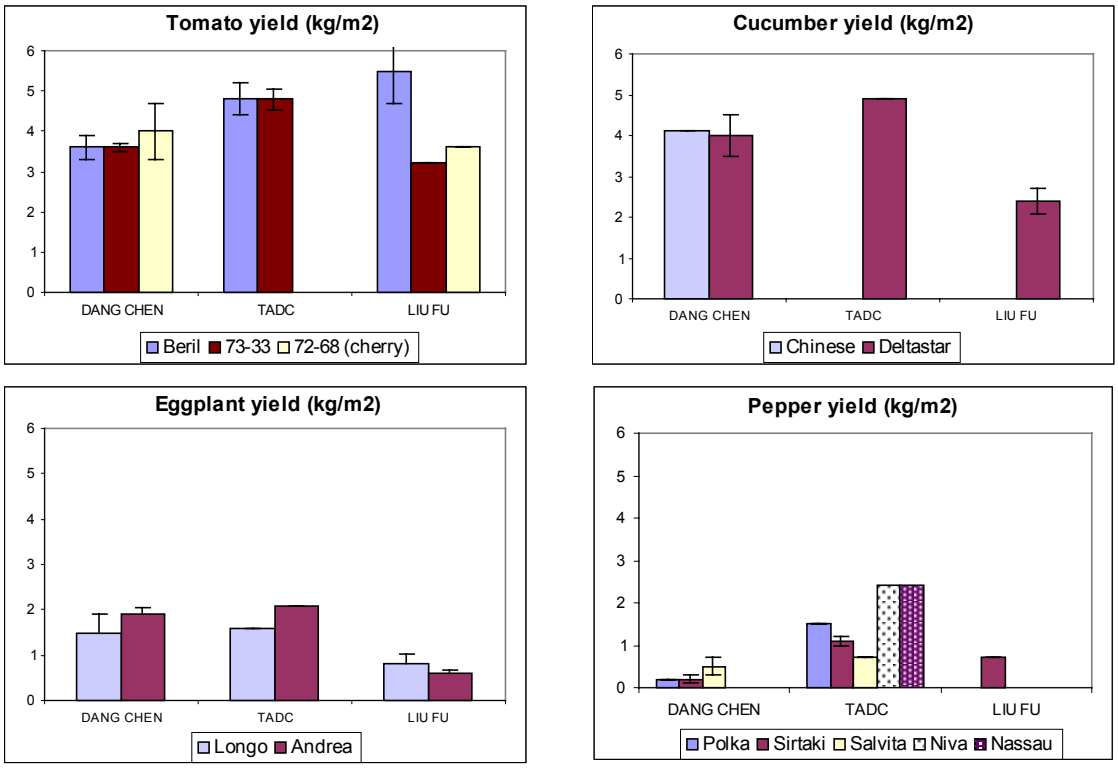

Figure 1. Yields (kg m^{-2}) obtained for four vegetable species in Dang Chen, TADC and Liu Fu during the spring planting season 2001.

Two different varieties of **cucumber** were monitored during the spring planting season 2001 (Figure 1).On average, the highest yields were achieved in TADC (4.9 kg m^{-2}) and the lowest yields in Liu Fu (2.4 kg m^{-2}), both for the Dutch Deltastar variety. Generally rather low yields were achieved with no difference between the two varieties.

Very low **pepper** and **eggplant** yields were achieved, especially in Liu Fu and Dang Chen (Figure 1), possibly partly due to the late planting date (for eggplant one month after the planting date in TADC). Moreover, some of these crops failed during the season due to diseases and growers stopped harvesting also because of market problems. The new unknown varieties were not suitable for selling on a small local market. In conclusion, late planting, lack of experience with the crops, and lack of marketing policy caused this failure.

As shown in Figure 2, when comparing the yields in this monitoring study with normal yields obtained in similar climates, for example Spain, the production in Tianjin is considerably lower. In Spain, an early tomato crop can achieve very easily around 15 kg m^{-2} under plastic greenhouses harvested in spring (Maroto, 1990). Currently, the average yields achieved in the Valencia Community of Spain in the similar spring season, under plastic greenhouses, are around 12-15 kg m^{-2} for cucumber and tomato, and between 7-8 kg m^{-2} for pepper and eggplant, depending on the year.

Rijk Zwaan provided interesting data on the potential crop production that could be achieved in Northeast China for the varieties used in the monitoring study. For example, tomato yield in autumn planting season can attain 10 kg m^{-2} and in spring 15 kg m^{-2} . Yields of 10 kg m^{-2} for the spring season were also reported by private farmers in the Tianjin area. These data express clearly higher yields than the ones obtained in our study. We conclude that vegetable production in the studied Tianjin area can still be improved substantially, where attention should be given to both growth conditions and crop management.

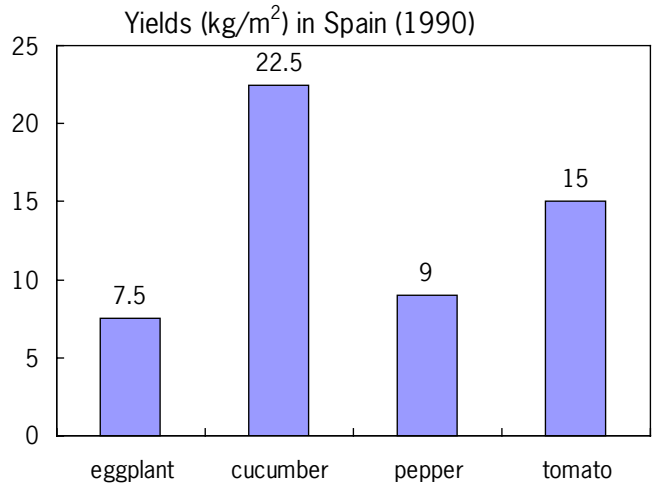

Figure 2. Yields (kg m^{-2}) obtained for four vegetables in Spain under plastic greenhouses in 1990 (Maroto, 1990).

Due to the uncertainty regarding the nutrient contents of the organic manures applied in TADC and Dang Chen, only the nutrient inputs with inorganic fertilisers are taken into account in the figures. Different types of organic manure were added at both sites (mostly dried chicken manure and municipal waste), but in Liu Fu only inorganic fertilisers were applied (mainly compound fertilisers). The high nutrient content (especially N) in chicken manure is characteristic of this type of manure (Pascual & Noguera, 1997). Thus, the input of nutrients with the organic manures must have been high; in most greenhouses the input of nitrogen with organic manure will probably have exceeded the nitrogen input with mineral fertilisers.

The highest amount of irrigation water was applied in all greenhouses of **Liu Fu** . Especially in Liu Fu, the variation in inputs was very large: the highest amounts of N input of all cases, from 845 kg ha^{-1} in pepper until 991 kg ha^{-1} in eggplant, while no nitrogen at all was applied in tomato. Fertiliser input of phosphorus and potassium was neither recorded for the cucumber crop. In addition, no pesticides were applied for both pepper and eggplant but a high amount was applied in cucumber (10.5 kg ha^{-1}). One can wonder whether the current patterns of pesticides used are efficient and appropriate.

In order to achieve high yields and profits, excessive amounts of inorganic N fertilisers were applied in Liu Fu, but this did not result in high yields. Higher yields were obtained in TADC with much less N fertiliser (in all crops except tomato).

The tomato greenhouses in Liu Fu (Table 5), that were irrigated with the highest amounts of water (between 577 mm and 1380 mm), had the highest and the lowest yields (between 3.2 kg m^{-2} and 5.5 kg m^{-2} , respectively), whereas similar yields were obtained in Dang Chen and TADC with a much lower irrigation input (around 317 mm).

Large differences were found also between the different greenhouses in **Dang Chen**. Figure 3 shows the inputs of nitrogen, water and pesticides; the table shows that there is no relationship between yields and inputs. The number and the timing of applications were also different between the greenhouses. For instance, in Dang Chen for 'Deltastar' variety of cucumber, the highest amount of water for irrigation was recorded in the 1-12 greenhouse with 16 applications, while only 2 applications of irrigation water were carried out in the greenhouse number 1-10.

Figure 4 shows that there is no relationship between inputs (irrigation, pesticides and N-P-K inputs) and yields of each different greenhouse, despite the large variation in inputs. This illustrates the lack of any standard criterion in the practical management of the greenhouses. The amounts of inputs recorded vary considerably from one site to another for the same variety, and there is also variation between greenhouses with the same varieties within one site. Figure 4 also shows that the eggplant in TADC greenhouse number A5 had higher yield (2.9 kg m^{-2}) with lower N-P-K inputs than greenhouse number 17 of Liu Fu (0.7 kg m^{-2}). Also, significantly higher cucumber yields were obtained in TADC (A6) at the lowest irrigation amount of 466 mm and a lower nitrogen input than Liu Fu (S1). It can be concluded that generally the inputs were too high to cause any effect on yield.

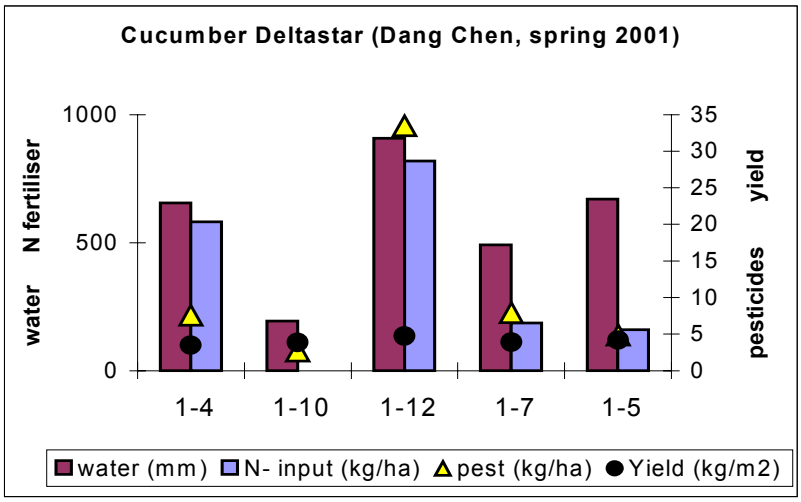

Figure 3. *Yields (kg m^{-2}) and inputs in nitrogen (kg ha^{-1}), pesticides (kg ha^{-1}) and irrigation (mm) for the cucumber crop in the greenhouses of Dang Chen during the spring planting season 2001.*

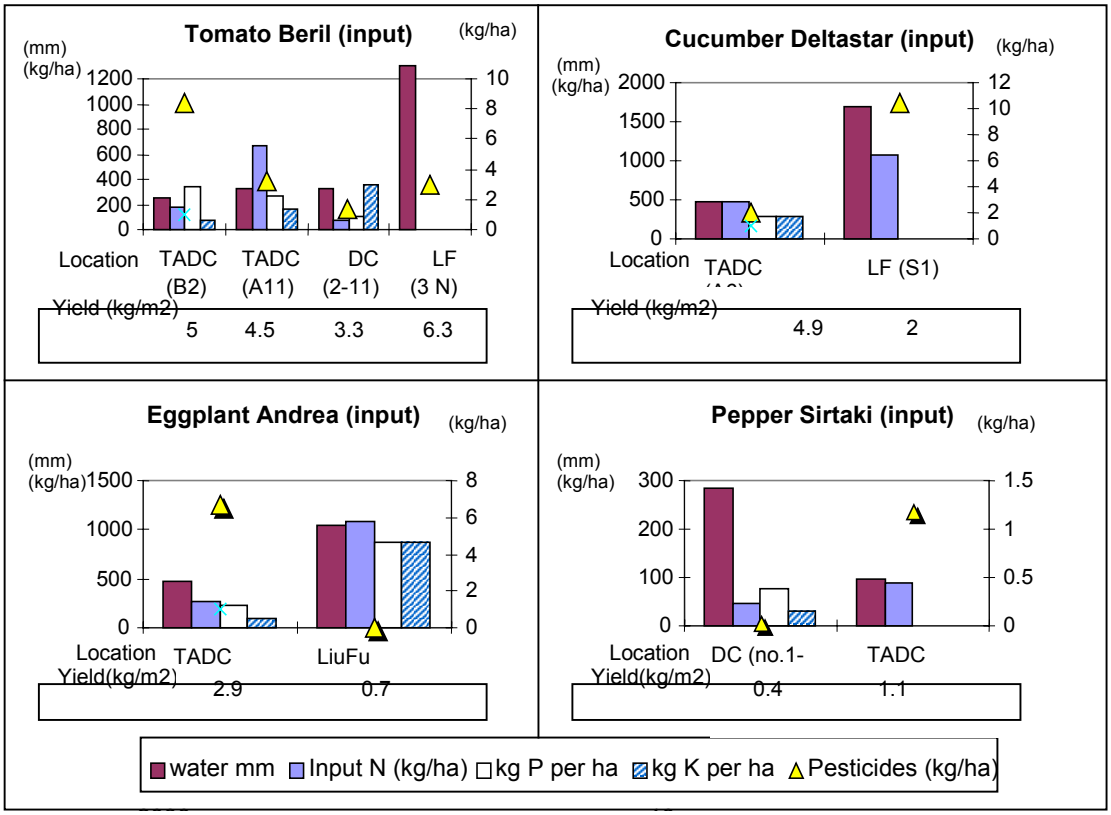

Figure 4. *Yields (kg m^{-2}), inputs of N, P_2O_5 and K_2O (kg ha^{-1}), pesticides (kg ha^{-1}) and irrigation (mm) for the varieties 'Beril' (tomato), 'Deltastar' (cucumber), 'Andrea' (eggplant) and 'Sirtaki' (pepper) in the greenhouses of TADC, Liu Fu, and Dang Chen during the spring planting season 2001.*

Conclusions from the spring planting season 2001:
- The highest yields were obtained in tomato and cucumber crops, mostly in TADC. The Dutch varieties of tomato and mini-cucumber gave reasonable results.
- Generally, the Dutch varieties of sweet pepper and eggplant did not produce well and they were hard to sell on the local market. This was primarily due to a lack of experience of the growers.
- The variability in the inputs of the different greenhouses was very high.
- The variation in amounts of inputs was highest in Liu Fu, despite the central management at this site.
- The crops showed no relationship between input and yield.
- The growers do not have guidelines for the management of inputs and crop growth.

6.2 Results of the data analysis on the autumn planting season 2001

In this season monitoring was carried out only at TADC. The results on yields were variable for the different varieties of each crop. For example, the yields of the cucumber crops of the autumn planting season 2001 were variable, but rather poor, with 2.5 kg per m^2 as maximum yield (Table 6). The other crops produced very little before the winter and were continued in the spring season. A large part of the tomatoes was, e.g., harvested during January and for a smaller part in May, but also until June with a very low production. The production was variable, but mostly considerably higher than in the spring season 2001 and a reasonable part could be sold at higher prices in winter.

On average, the highest yields were achieved (9.1 kg m^{-2}) with the Beril Dutch tomato variety. The highest average pepper yields were obtained with the Chinese variety (7.7 kg m^{-2}) and the Dutch Leila variety (7.4 kg m^{-2}).

As shown in Figure 5, quite similar inputs were applied in the different greenhouses for each crop and different yields were achieved depending on the variety; higher tomato yields were obtained with the Melvin and Beril varieties with almost the same input as the other varieties.

Different types of organic manure were applied, but only chemical fertilisers are taken into account in the figures of Table 6. Additionally, high amounts of nitrogen fertilisers were applied in all greenhouses, specially in pepper and eggplant, with no measurable effect on production.

Table 6. Yields and inputs; minimum and maximum values, standard deviation and averages per variety at TADC during the autumn planting season 2001.

		Yield (kg/m²)				Pesticides (kg/ha)				N-input (kg/ha)			
Cucumber	Variety	min.	max.	st. dev.	average	min.	max.	st. dev.	average	min.	max.	st. dev.	average
	Chinese trad.				0.3				0.19				470
	Chinese mini				2.3				0.15				283
	22-72	1.4	2.5	0.8	2.0	0.15	0.47	0.22	0.31	283	470	132	377
Eggplant	Chinese				3.6				0.6				2012
	Chinese green				4.3				0.6				2014
	Andrea				4.9				0.6				1988
Tomato	72-68	2.1	2.7	1.3	2.4	1.2	1.4	0.1	1.3	449	495	32	472
	Jinan	2.9	3.0	0.6	2.9	1.2	1.2	0.0	1.2	402	495	66	448
	Melvin	4.8	5.5	4.5	5.5	1.4	1.4	0.0	1.4	500	500	0	500
	Beril	7.3	10.8	0.1	9.1	1.4	1.4	0.0	1.4	505	512	5	508
Pepper	Sirtaki	4.2	4.7	0.3	4.4	0.5	0.5	0.0	0.5	918	1145	160	1031
	Salvita	5.3	5.4	0.1	5.3	0.5	0.5	0.0	0.5	917	1147	163	1032
	Niva	5.4	7.2	1.3	6.3	0.5	0.5	0.0	0.5	878	1035	111	957
	Nassau	5.7	6.8	0.8	6.2	0.5	0.5	0.0	0.5	921	1148	160	1035
	Leila	6.4	8.4	1.4	7.4	0.5	0.5	0.0	0.5	922	1149	160	1036
	Chinese	7.6	7.8	0.2	7.7	0.5	0.5	0.0	0.5	918	1149	163	1033

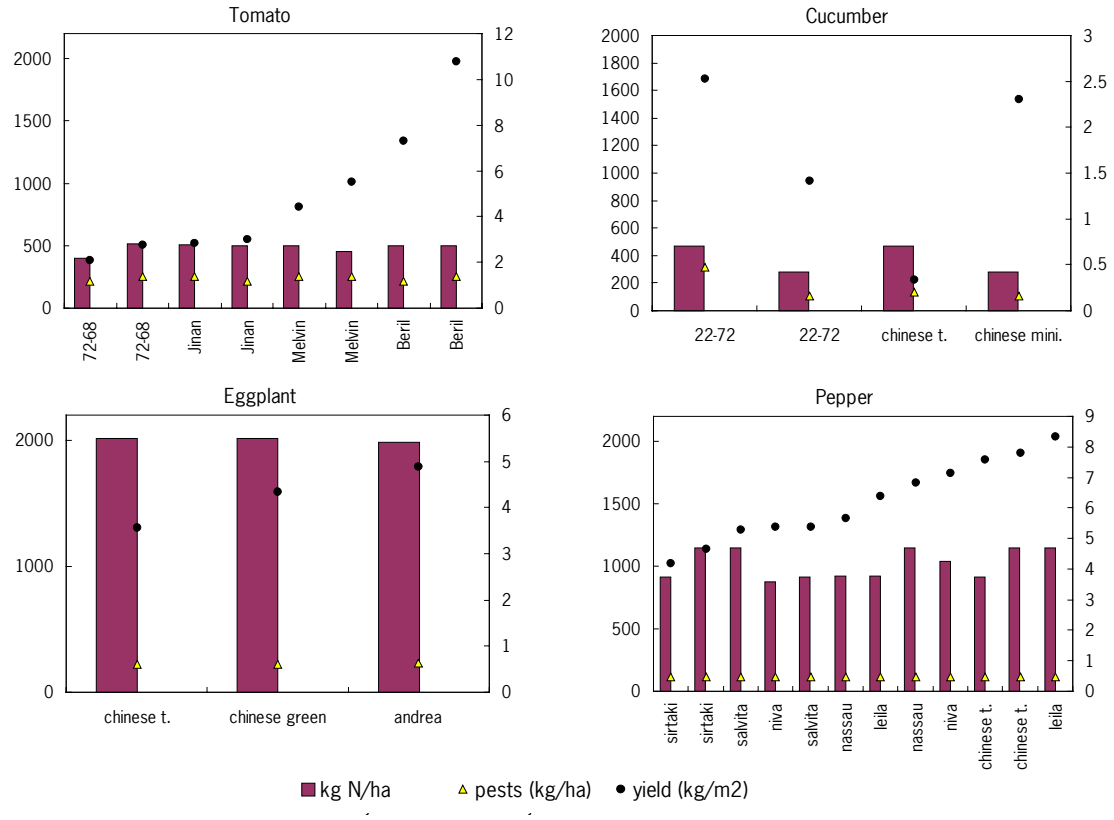

Figure 5. Yields (kg m^{-2}) and inputs of nitrogen (kg ha^{-1}) and pesticides (kg ha^{-1}) for cucumber varieties in the greenhouses of TADC during the autumn planting season 2001.

Conclusions from the autumn planting season 2001:
- Yields were variable for the different varieties of each crop.
- The cucumber varieties gave variable results at a generally low production level, achieving 2.5 kg per m^2 as maximum yield.
- The other crops were continued after the winter and attained reasonable yields.
- The Beril tomato variety attained higher yields (up to 10.8 kg m^{-2}).
- The variability of the inputs within crops was low.
- The input of nitrogen for pepper and eggplant was extremely high, from 1000 to 2000 kg ha^{-2}, not taking the nitrogen from organic manure into account.
- The input of nitrogen for cucumber and tomato was similar to the input of the spring season of 2001.

6.3 Results of the data analysis on the spring planting season 2002

The cucumbers in the plastic greenhouses produced better than in spring 2001, especially the 'Deltastar' variety in TADC, harvesting up to 8.2 kg m^{-2} in the A4 greenhouse with traditional flooding irrigation (Table 7). Higher yields were found for the Dutch variety of mini-cucumber than for compared the Chinese variety. In some greenhouses higher amounts of fertilisers were applied than in the preceding spring season.

The fertigation system newly installed in TADC functioned well, with higher yields as a result, but a lack of clear recommendations was noticed. The amount of irrigation water applied by drip irrigation (with fertigation) in the A2 and A3 greenhouses was much lower than in the other greenhouses (Figure 6), but still high, and the soil was wet most of the time, probably too wet. Furthermore, the amounts of nutrients in the fertigation system were based on the use of soil-less cultures, while large amounts of nutrients were available from the manure applied at the start of the season. Nevertheless, the crops under the fertigation systems reached higher yields (compared to last season), harvesting up to 8.21 kg m^2, but the same yield was obtained in the A4 greenhouse with flooding irrigation and traditional application of solid fertilisers. It is obvious that the benefits of the fertigation system, constant optimal soil conditions while saving water and nutrients, can without adequate recommentations only partly be utilised.

Table 7. *Yields and inputs; minimum and maximum value, standard deviation and averages per variety during the spring planting season 2002. * greenhouses with fertigation system.*

			Yield (kg/m²)				Pesticides(kg/ha)				N-input (kg/ha)				Water (mm)			
			min.	max.	st. dev.	average	min.	max.	st. dev.	average	min.	max.	st. dev.	average	min.	max.	st. dev.	average
Cucumber	TADC	Deltastar*	8.0	8.2	0.2	8.1	2.5	3.2	0.5	2.9				256				300
		Chinese*	6.2	7.1	0.6	6.6	2.5	3.2	0.5	2.9				256				300
		Deltastar	5.5	8.2	1.4	6.7	1.8	5.4	1.8	3.8	607	1042	246	758	498	680	125	574
		Chinese	4.4	5.0	0.4	4.7	4.2	5.4	0.8	4.8	607	1042	307	825	498	680	166	589
		090				4.1				1.8				625				543
		126				3.2				1.8				625				543
		MUGE				3.5				1.8				625				543
	Liu Fu	22-21				1.4				8.7				410				
		Radiant				2.3				1.8				682				
		Deltastar	2	2.4	0.1	2.3	3.2	3.8	257.5	3.3	715	1193	200	899				
		Condesa				1.2				5.7				847				
	Dang	22-21				2.1				9.7				515				
	Chen	Radiant				1.6				7.6				249				
		Deltastar	1.5	6.3	2.0	4.2	7.9	29.5	8.1	17.2	219	917	242	626				
		Condesa	1.4	3.2	0.9	2	5.4	6.6	0.5	6	194	582	194	372				
Tomato	Liu Fu	Beril				4.2				4.0				452				
		Jinan	4	4.5	0.3	4.3	4.3	5.1	0.6	4.7				580				
		Melvin	4	4.7	0.1	4.6				5.1	524	580	40	552				
	Dang	Beril	3.7	5.6	0.8	4.5	2.6	6.8	1.3	4.3	42	463	126	207				
	Chen	Jinan	4.6	4.9	0.2	5	2.3	6.8	3.2	5	97	203	75	150				
		Melvin				3.7				2.3				180				

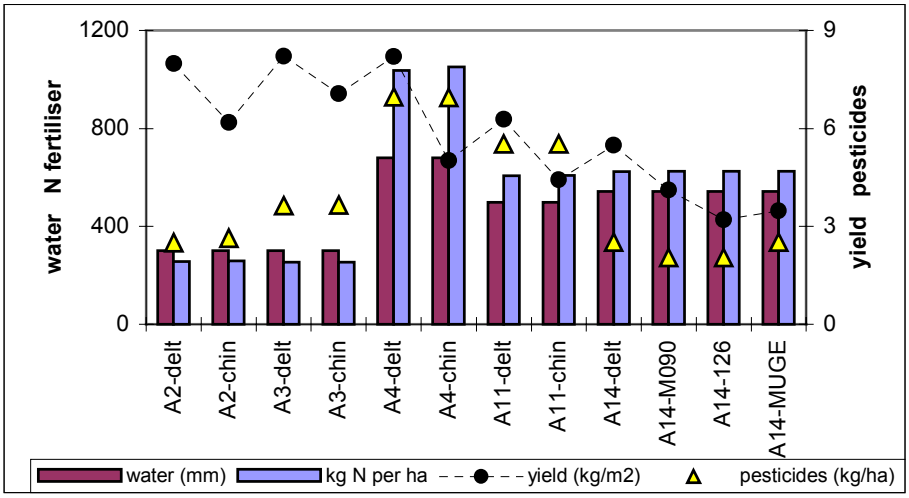

Figure 6. *Yields (kg m^{-2}) and inputs of nitrogen (kg ha^{-1}), pesticides (kg ha^{-1}) and irrigation (mm) for the cucumber crop in the greenhouses of TADC during the spring planting season 2002.*

The daily nutrient dose level in the fertigation system (A2 and A3) was based on the needs of a crop in soil-less culture. Too high amounts of phosphorous and potassium were applied (Figure 7), probably resulting in an over-dose of nutrients possibly also in a lack of equilibrium in nutrient supply. This could be the reason for an obvious deficiency, (most probably the micro-nutrient zinc) in a number of plants. Nevertheless, yield was comparable with the traditional system and further improvements will be possible. Yield was lower in greenhouse A11, probably due to a difference in the soil, resulting from differences in soil amelioration at the establishment of TADC in 1999.

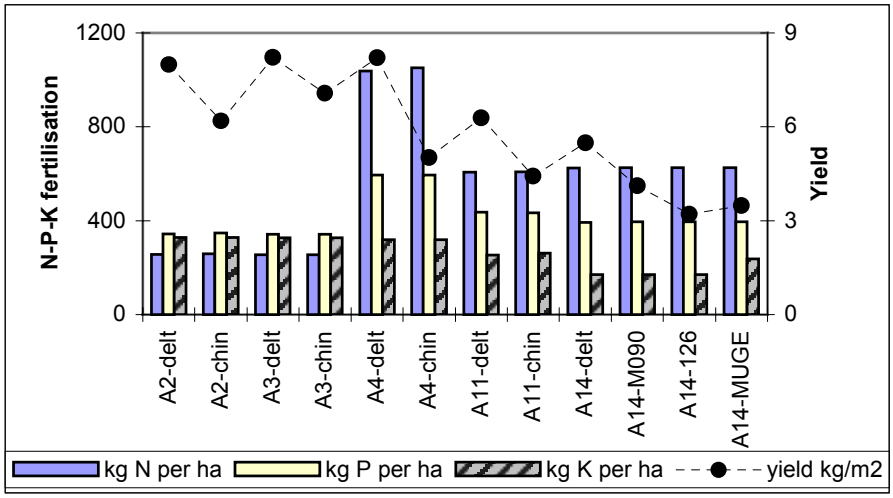

Figure 7. *Yields (kg m^{-2}) and N,P_2O_5 and K_2O inputs (kg ha^{-1}) for the varieties of cucumber in the greenhouses of TADC during the spring planting season 2002.*

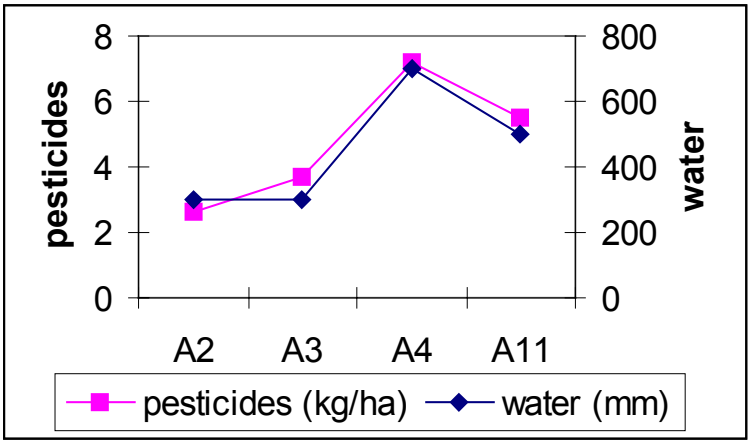

Figure 8. *Inputs of pesticides (kg/ ha) and irrigation water (mm) for the cucumber crop at TADC during the spring planting season 2002.*

A clear relationship was found in the greenhouses of TADC between irrigation and pesticides input: when a higher amount of irrigation water was applied, more pesticides were used. The use of more water may have led to a higher humidity in the greenhouse, resulting in the occurrence of more pests (Figure 8).

In Dang Chen and Liu Fu, growth was similar to that in the preceding spring season, with more variation in yields and also high inputs of fertilisers and pesticides (Figure 10).
Management in each greenhouse was very different, probably due to the different farmers working in these greenhouses (Figure 9). Again, no relation between the input level and yield could be found, while the input levels still showed a large variation. Figure 9 shows for tomato growers in Dang Chen that the yields obtained by one farmer in two greenhouses of the same crop are very much the same, despite often considerable differences in nitrogen and pesticides input. This shows that the variation in yield is mainly a variation between individual growers, and not between greenhouses. This implies that the large variation in yields is not so much determined by t the input level but probably more by general crop management.

Differences in varieties were mostly small, except for some varieties (e.g. Condesa, Radiant and 22-21) which seem to be unsuitable for the local conditions.

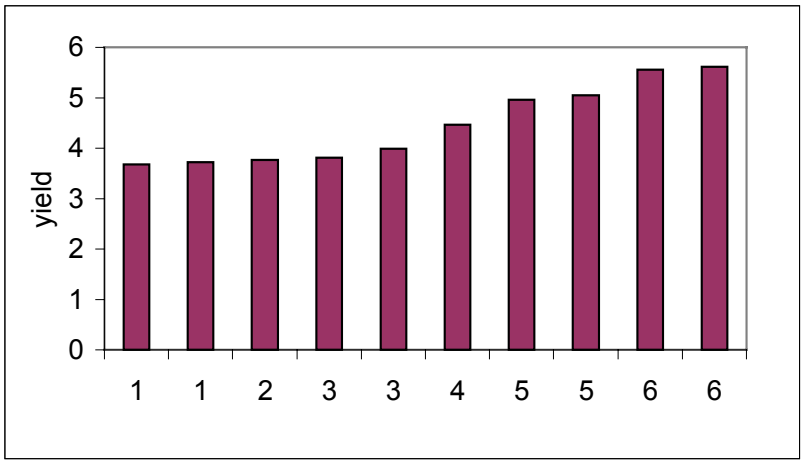

Figure 9. Tomato yields of Beril variety (kg per m²) attained by six different growers in Dang Chen during the spring planting season 2002.

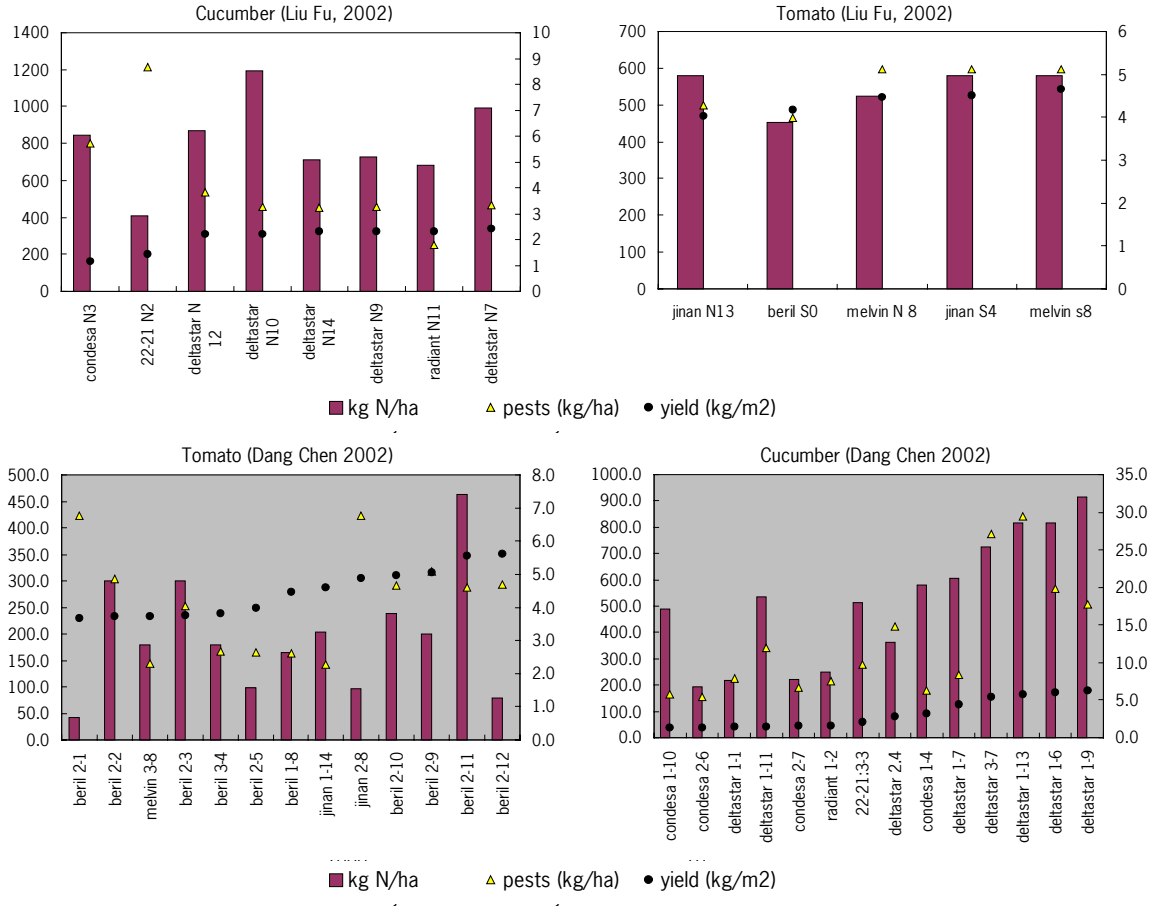

Figure 10. Yields (kg m^{-2}) and inputs in nitrogen (kg ha^{-1}) and pesticides (kg ha^{-1}) for cucumber and tomato varieties in each greenhouse of Dang Chen and Liu Fu during the spring planting season 2002.

Conclusions from the spring planting season 2002:

- Dutch varieties of tomato and mini-cucumber gave highly variable results.
- The production levels were not related to inputs, but probably to general management.
- The newly installed Dutch fertigation system resulted in clearly lower inputs of fertilisers, water and pesticides and maintained production levels.
- Comparable inputs and production levels might be reached with traditional drip irrigation systems and careful fertiliser application.
- The farmers in Dang Chen and Liu Fu clearly need more experience and explicit guidelines to reach or maintain profitable production levels with lower inputs and more efficient use of inputs.

6.4 Soil and Water

Soil

The nutrient status of the soil (available P and K) of the soils in the monitoring study is good to high, sometimes even very high. The heavy metals contents were lower than the limits for 'Pollution Free Vegetable Production' for all soils involved.

Soil analysis figures are shown in Tables 4.1 and 4.3 of Appendix IV. The results of the heavy metal analyses are shown in Table 4.2.

To determine and optimise the proper amount of chemical fertilisers to be applied to different crops in the greenhouses, it is necessary to analyse the data on total amounts of nitrogen, phosphorus and potassium that are removed with the harvest (products and crop residues) (Sheldrick *et al.,* 2002). Therefore, a simple **N, P and K balance** was calculated using N-P-K input (through applied fertilisers) and N-P-K output (removal by the crop) in a number of greenhouses of Liu Fu, Dang Chen and TADC. Estimates of the total nutrient balance analysed are presented in Appendix I (Table 1.15) and in Table 8.

Different crops show a different utilisation of inputs and obtained yield. Many factors determine the nutrient balance of an ecosystem and the results obtained in this study cannot themselves answer questions of the overall adequacy of chemical fertilisation in the study area. The primary data collected in the present study are insufficiently exhaustive to evaluate the soil nutrient balance. For example, the nutrient input with organic manures could not be taken into account. As a consequence, no conclusive evidence is given about the possible effect on crop productivity due to possible modification of the amount of N-P-K fertilisers applied.

However, taking into account these limitations, the result of this study clearly shows the existence of an excessive nitrogen, phosphorus and potassium fertilisation surplus due to the very high inputs. For example, N surplus at TADC (in 2001) was between 1073 kg N ha^{-1} and 613 kg N ha^{-1}, resulting in a percentage of N fertiliser crop uptake of 9% and 16%, respectively, of the applied amount of nitrogen (Table 8). In fact, these percentages are even lower because the nitrogen input with manure, at least several hundreds of kg ha^{-1}, could not be taken into account.

Table 8 shows also that the nutrient use efficiency was much higher in the fertigation system, 40 to 60% instead of 8 to 20% for the traditional flooding irrigation system. Also here, the actual percentages must be lower because of the application of manure, but it is clear that nitrogen use efficiency can be largely increased by lowering fertiliser input without negative effects on the yield.

In Liu Fu village, no manure was applied to the greenhouses, but very high inputs of chemical compound fertilisers were used in most greenhouses and the percentage of nitrogen taken up by the plants was still very low.

Beyond a certain threshold, nutrients applied as chemical fertilisers are not taken up by plants and may be lost to the environment. The low percentage of N fertiliser applied that is taken up by the crop, shown in Table 8, indicates very large potential losses of nitrogen to the environment, of which leaching to the groundwater is probably most problematic (Zhang *et al*., 1996). Furthermore, excessive N fertilisation can be harmful, and NO_3-N accumulation is a problem in many crops (Ramos *et al*., 2001; Blanc & Morisot, 1980). It can also increase vegetative growth and decrease commercial yield. Lodging may occur when under abundant nitrogen supply (during the early development stages of a crop stem) elongation is promoted. Elongation can weaken the plant and increase its susceptibility to diseases (Lovenstein *et al*., 1995)

Table 8. Nitrogen balance: applied N fertiliser, removal with crop (product and crop residues), surplus and percentage (%) of N fertiliser applied taken up by crop.

Sampling location	Greenhouse number	Crop and variety	Yield (kg m^2)	Applied N fertiliser (kg N ha^{-1})	Removal with crop ** (kg N ha^{-1})	Surplus (kg N ha^{-1})	% of N fertiliser applied, removed with the crop
TADC 2001	A6	Cucumber Deltastar	4.9	1185	112	1073	9
	A5	Tomato 73-33	5.0	733	120	613	16
	A4	Eggplant Andrea	1.8	869	86	783	10
	A3	Pepper Nassau	2.4	715	86	629	12
Liu Fu 2001	S11	Cucumber Deltastar	2.8	742	104	638	14
	Out6	Eggplant Longo	0.5	845	60	785	7
	Out11	Pepper Niva	0.1	811	51	760	6
Dang Chen 2001	1-10	Cucumber Deltastar	3.8	375	136	239	36
	2-5	Tomato Beril	3.4	381	93	288	24
	1-6	Eggplant Longo	1.8	602	75	527	12
	3-4	Pepper Salvita	0.6	434	63	371	15
TADC 2002	A2 (*)	Cucumber Deltastar	8.0	256	159	98	61
		Cucumber Jinyou10	6.2	258	145	113	50
	A3 (*)	Cucumber Deltastar	8.2	254	154	100	44
		Cucumber Jinyou10	7.1	254	143	111	40
	A4	Cucumber Deltastar	8.2	1037	175	863	13
		Cucumber Jinyou10	5.0	1051	128	923	8
	A11	Cucumber Deltastar	6.3	607	156	450	20
		Cucumber Jinyou10	4.4	608	115	493	16
	A14	Cucumber Deltastar	5.5	624	158	467	18
		Cucumber 090	4.1	626	127	499	13
		Cucumber 126	3.2	626	96	529	10
		Cucumber Muge	3.5	625	112	513	12

* *greenhouses with fertigation system*

** *including 50 kg ha^{-1} as estimated N removed with crop residues*

The mineral nitrogen content at the start of the growing season was extremely variable and is not taken into account in the application of fertilisers. Since values of up to 500 kg ha^{-1} N were found (Appendix IV, Table 4-1) taking these into account could save much fertiliser. In fact, one greenhouse with tomato in Liu Fu received no fertiliser or manure N at all and had one of the highest yielding crops. A regular monitoring of the amount of available nitrogen at the start of the growing season would help to adjust the input of nitrogen to the needs of the plant and could lead to a considerable reduction in fertiliser use and an increase of the nitrogen use efficiency.

It is concluded that the inputs of nutrients are unnecessarily high, specially the input of nitrogen, and clear practical guidelines taking also into account the available amounts of nutrients before fertiliser application are needed. In order to give an overall evaluation of the fertilisation practices (in terms of amount and timing) and to make practical guidelines for optimal nutrient efficiency use, this study points out the necessity of further research on the effects of strongly decreased nutrient applications on yields and on the dynamics of plants nutrients in the soil.

Generally, the soil of the Tianjin Xiqing district is a heavy clay soil, with a poorly developed structure, a low organic matter content and a rather high salinity. For optimal vegetable production the soil needs amelioration. Especially an increase of the organic matter content should lead to a better structure. For this purpose the use of a large quantity of manure with much resistant organic matter and low nutrient contents (e.g. straw) is necessary. Furthermore, the salinity needs continuous attention regarding the choice of crops and varieties and water management. Preferably, rainwater should be collected and used, since its salt content is much lower than that of the available river and well water. A careful planning and timing of the application of a water surplus for leaching of excessive salts is needed to prevent increasing salinity while maintaining an efficient use of the scarce water supplies.

Water

The results of the nitrate, pH and EC analyses are presented in Table 4.1 of Appendix IV.

The **nitrate** content of irrigation water from the different wells varied between 0 and 23 mg/l. In the water coming from the river in Dang Chen it was 135 mg/l. This river water could make an important contribution to the nitrogen input of the soil, although it was used only during a part of the growing period. High nitrate contents of the irrigation water, in combination with high nitrogen application rates in fertilisation increase the potential of groundwater N pollution.

The irrigation water showed a high **salinity**, especially in Dang Chen and Liu Fu, where it was higher than 3 mmhos/cm. In tomato, a salinity higher than 2.3- 5.1 mmhos/cm can already result in an undesirable yield reduction (Dorais *et al.*, 2001) while fruit quality is improved. Furthermore, when the electric conductivity of the irrigation water is higher than 3 mmhos/cm (FAOSTAT, 2002), production can be negatively affected and only with permeable soils or tolerant varieties satisfactory yields can be achieved. In the future, soil salinity can become an increasing problem. Thorough water management will be needed, and the utilisation of rainwater will probably become inevitable.

Groundwater

The nitrate contents in the upper groundwater layer were high, the average for five greenhouses at TADC was 640 mg per litre (inside the greenhouses). Outside the greenhouses the nitrate contents were lower, but still high, around 100 mg per litre. The World Health Organisation standard maximum value for nitrate content for drinking water is 50 mg/l. In the long term this could affect the nitrate content of the deep groundwater, which is used for irrigation. At TADC this water was at this moment still free from nitrate.

Table 4.4 (Appendix IV) shows the realties of the groundwater analyses.

High nitrogen fertilisation levels enhance the already existing problem of the high nitrate contents of groundwater in large parts of China (Zhang *et al.*, 1996).

Irrigation practices do interact strongly with nutrient demands. Excess of irrigation water will leach downward into the soil and will bring nutrients to deeper soil layers. Here, nutrients cannot be absorbed by the crop any more, and will eventually be lost to the groundwater. Especially the leaching of nitrogen is a problem. The international drinking water standard of 50 mg of nitrate per litre in groundwater under horticultural crops is commonly strongly exceeded, and with an increasing frequency. The concern of keeping good quality forces also to minimise the nitrogen input in horticulture, while maintaining a high production level. Fertilisers are being increasingly used and fertiliser N is inefficiently managed. In the future, with increasing fertiliser N application rates, the possibility of nitrate pollution of groundwater will be strongly linked with fertiliser N use efficiency (Bijay Singh *et al.*, 1999).

6.5 Quality

Analysis of visual quality (in % first class) was carried out only at TADC; at the other sites the ungraded products were sold. Results on vitamin C, nitrate, sugars and dry matter are shown in Tables 5.1 and 5.4 of Appendix V.

Concerning product quality, there is some variation in results of the fruit chemical analysis. In terms of human health, the tomato for example, is one of the most important horticultural crops in the world, and it contained around 20 mg/100 g of vitamin C in most cases, which can be considered as a normal vitamin C content (Appendix V, Table 5.1). Furthermore, sweet peppers are very rich in vitamins, especially vitamins A and C (Salunkhe & Kadam, 1998); they contained an average of 97 mg/100 g of vitamin C.

On the other hand, generally high nitrate contents were found, varying from 430 to 830 mg kg^{-1} for cucumber, from 170 to 330 mg kg^{-1} for tomato, from 530 to 860 mg kg^{-1} for eggplant and from 340 to 940 mg kg^{-1} for peppers (Appendix V, Tables 5.1 and 5.4). In some cases significantly higher nitrate contents were found in the fruits than in other cases, probably due to the high amounts of nitrogen fertiliser applied. An example: 'line 3-4' and 'line 3-3' of pepper greenhouses in Dang Chen (Figure 11) were fertilised with large quantities of nitrogen, showing almost double nitrate contents in the fruits (944 mg kg^{-1} and 889 mg kg^{-1}, respectively) compared to the ones with less fertiliser input. The relationship between nitrogen fertiliser input and nitrate content of the fruits is shown in Figure 11 for peppers in Dang Chen in the spring season of 2001. The fruit crops of this study are low in nitrate compared to other vegetable crops, like leafy and root vegetables, in which crops very high nitrate contents would be expected if these would be grown under the principle of the avoidance of any risk of nutrient deficiency without analysing the actual nutrient status of the soil.

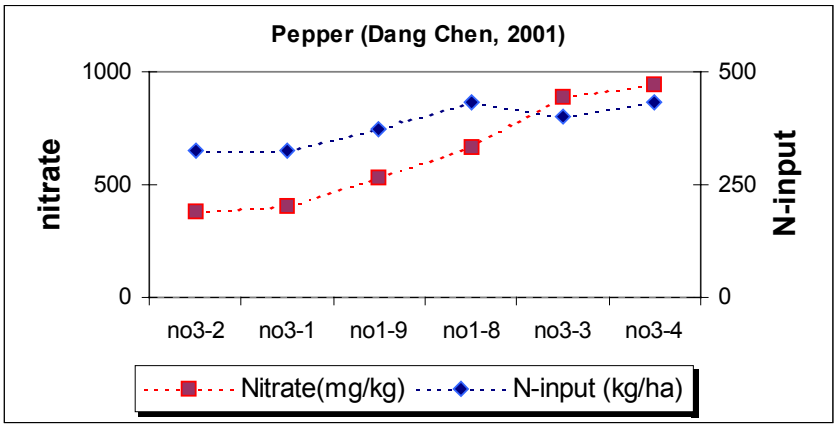

Figure 11. Relationship between the nitrogen fertilisation input and nitrate contents in the pepper fruit.

High nitrate applications result in an increase of this anion in fruit (Ruiz & Romero, 1999) and vegetative growth is rapid with a reduction in the carbohydrate concentration (Salunkhe & Kadam, 1998).

No residues of harmful pesticides were found in the samples of the products. Analysis for the residues of the pesticides normally used in the crops was not yet possible in this project. Equipment for this purpose is very important, because routine analysis for pesticide residues is a necessity to guarantee food safety.

6.6 Product marketing

The prices of the harvested products showed variation during the year. For example, during 2001, cucumber prices decreased from 1.8 Yuans per pound at the end of March to 1.2 Yuans per pound at the middle of May, followed by a price increase to 2 Yuans per pound during the summer until the middle of August (Figure 12). In Dang Chen in spring 2002 many tomato crops were planted late with the purpose to produce less in spring and more in full summer when the market price is expected to be substantially higher. Nevertheless, the price for tomato was very low, around 0.3 Yuans per pound, achieving very low income and the price remained low during summer. On the other hand, tomato prices at TADC were higher, especially during the winter (between 1 and 3 Yuans per pound, achieving highest levels in February), decreasing to 0.5 Yuan per pound in June and remaining low during the summer.

The marketing of the produced vegetables went rather well. TADC found new outlets and succeeded in closing contracts with supermarket chains in addition to selling via the wholesale market and on open street markets. In particular the mini-cucumber was a success. Even 'third quality' was sold easily on the open street markets. Cherry tomatoes were also easily sold. They are consumed as fruit, and are in particular favoured by children. Important in this respect is also that TADC installed nine cold stores, which would reduce post-harvest losses and allow a more adequate anticipation on expected market fluctuations.

The selling of eggplants, however, appeared difficult. In particular the growers in Xinkou Town could not find buyers, while they had ten greenhouses with eggplants. The growers in Xinkou Town showed a more passive approach, concentrating on production. As a result, they were completely dependent on a few mediators. The local consumers were not familiar with the long-shaped Dutch eggplant. They prefer the round-shaped Chinese varieties. With the help of Rijk Zwaan and TADC most of the eggplants were sold eventually.

Sweet peppers reached production in a late stage and for that reason the growers could not sell them at reasonable prices.

In 2002 no pepper and eggplant were grown, but tomato prices were extremely low and only cucumber, especially mini-cucumber, was profitable.

In 2001 the group of individual growers of Dang Chen showed more market orientation and had more success than the collective association of Liu Fu.

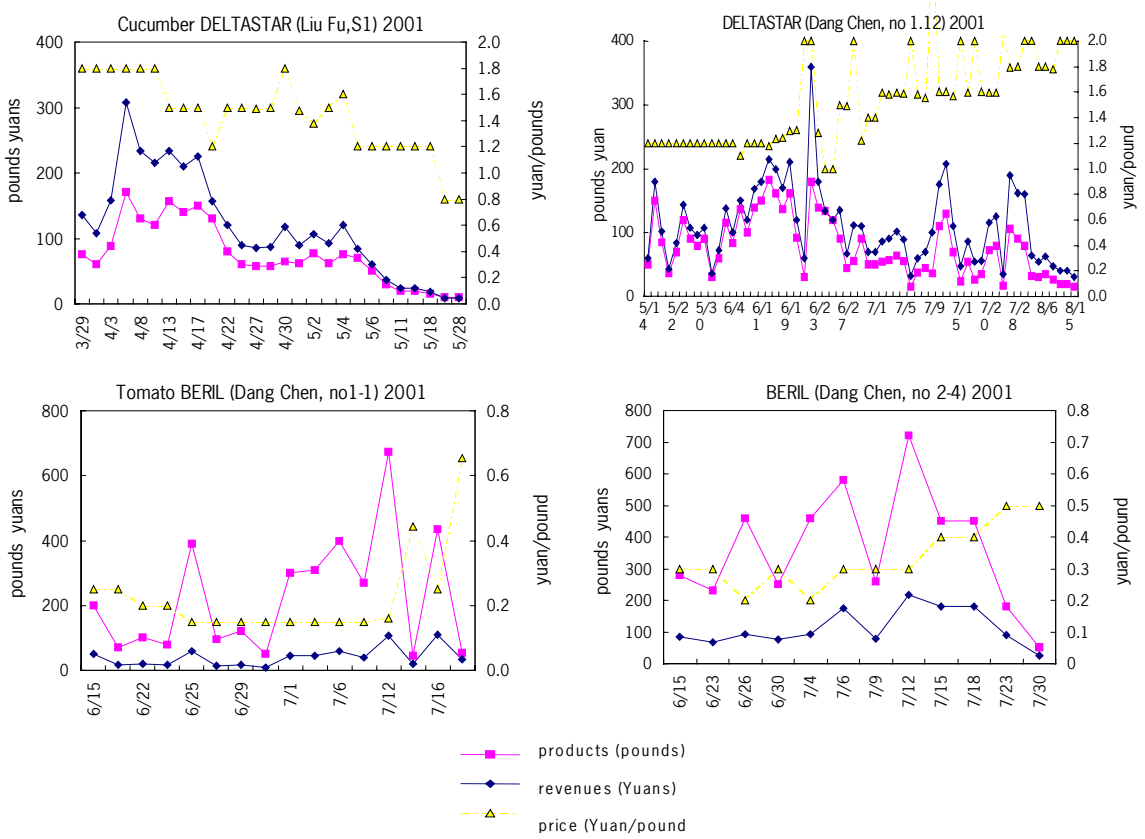

Figure 12. Prices in Yuan per pound for the Deltastar (mini-cucumber) and Beril (tomato) varieties during the spring planting season 2001.

7. Conclusions and recommendations

The introduction of Dutch tomato and cucumber varieties in Chinese vegetable production can be successful and is considered satisfactory in general. Especially the Dutch varieties of mini-cucumber can produce well in the Tianjin area and can easily be marketed. However, eggplant and pepper did not have satisfactory yields and faced marketing problems in the Tianjin area. For these crops more specialised growers with close market contacts might be successful.

However, although the technical results of growing Dutch tomato and cucumber varieties were mainly satisfactory taking into account that this was the first time that these varieties were grown, better production results are necessary for sustainable production and the technical knowledge about cultivation must be improved. The first steps in this direction were short training courses for people from Tianjin at the demonstration centre of Rijk Zwaan in Qingdao.

Vegetable production monitored in this study generally involved large inputs of water, pesticides and nutrients, with a high variation in both the amounts and the timing of the applications. Obviously, vegetable growers hardly have or apply any guidelines for the optimal inputs and generally use much more inputs than necessary. This results in the absence of any effect of the variation in inputs on yields. Furthermore, yields were highly variable and mostly clearly lower than could be considered as the optimum under the current conditions. Most probably, this variation was mainly caused by differences in crop management. Farmers clearly need more experience and explicit guidelines for general crop management and use of inputs to reach or maintain profitable production levels with lower and more efficient use of inputs. Standard on-farm monitoring of yields and inputs and regular analysis of the soil nutrient status are important and helpful management tools to improve the efficiency. A more efficient use of inputs will be beneficial for both economic and environmental reasons. This can only be reached with clear and solid-based recommendations for the use of inputs. Research is needed for the development of such recommendations

The concern of keeping the scarce water reserves of good quality and avoiding inefficient use of such reserves forces also to minimise nitrogen input in horticulture and to optimise irrigation management, while maintaining production at a high level. Groundwater quality will become a large problem in the future when fertilisation and irrigation practices do not change. The use of drip irrigation techniques and the collection of rainwater from the greenhouses could largely improve water use efficiency.

Heavy metal levels in all soils were low and below the level required for pollution-free production.

Residues of hazardous pesticides were not detected in any of the vegetable samples.

Vegetable growers in Tianjin already face overproduction and low prices for many crops. And since a profitable production system can only exist with intensive production methods with high yields, new markets must be opened soon to ensure further development of Tianjin vegetable production. A guaranteed food quality and safety is a prerequisite for new markets, within China and for export.. Regular monitoring according to (inter)national guidelines is needed to ensure this quality and safety and the establishment of a Routine Monitoring Laboratory for pesticide residues in Tianjin is an important step towards this guarantee.

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Appendix I.
Data on spring planting season 2001

Table 1.1. General data in TADC and averages of inputs and outputs of each greenhouse for the spring planting season 2001.

Greenhouse			Area		Planting	End	Number of plants			First harvest	Last harvest	Total fertilisers (kg/ha) (excluding organic manure)			
No.	Species	Variety	(mu)	(m^2)	date	date		per mu	per m^2	date	date	N-input	P_2O_5-input	K_2O-input	S-input
A6	Cucumber	Deltastar	0.4	267	2001.3.9	2001.7.25	728	1820	2.7	2001.3.28	2001.7.25	475	277	287	52
A4	Eggplant	Longo	0.4	267	2001.3.25	2001.8.9	756	1890	2.8	2001.5.21	2001.8.9	396	271	218	77
A4	Eggplant	Andrea	0.4	267	2001.3.25	2001.8.9	756	1890	2.8	2001.5.21	2001.8.9	396	271	218	77
A12	Pepper	Salvita	0.8	534	2001.3.24	2001.8.6	1512	1890	2.8	2001.6.7	2001.8.6	188	438	84	28
A2	Pepper	Niva	0.8	534	2001.3.25	2001.8.14	1512	1890	2.8	2001.6.1	2001.8.14	250	243	127	70
A3	Pepper	Nassau	0.8	534	2001.3.25	2001.8.14	1512	1890	2.8	2001.6.1	2001.8.14	242	179	41	41
B1	Pepper	Sirtaki	0.65	434	2001.3.25	2001.8.14	952	1465	2.2	2001.6.1	2001.8.14	90	0	0	0
B4	Pepper	Polka	0.65	434	2001.3.24	2001.8.14	1064	1637	2.5	2001.6.4	2001.8.14	302	168	92	38
C4	Pepper	Sirtaki	0.2	133								196	57	59	45
B2	Tomato	Beril	0.65	434	2001.3.4	2001.7.7	1064	1637	2.5	2001.5.20	2001.7.6	178	335	79	28
A11	Tomato	Beril	0.8	534	2001.3.5	2001.7.6	1512	1890	2.8	2001.5.13	2001.7.6	674	263	162	28
A14	Tomato	73-33	0.8	534	2001.3.5	2001.7.6	1512	1890	2.8	2001.5.15	2001.7.6	172	41	46	0
A5	Tomato	73-33	0.8	534	2001.3.4	2001.7.8	1512	1890	2.8	2001.5.13	2001.7.6	260	235	93	44

Greenhouse			Yield	Water	Pesticides	Soil		Product analysis results				
No.	Species	Variety	kg/m^2	total mm	total g/ha	NO_3-N mg/kg soil	$N_{(20\ cm)}$ kg/ha	% first class	% sugar	VitC mg/100g	Nitrate mg/kg	DM (%)
A6	Cucumber	Deltastar	4.94	470	2023	139.8	363.48	5	2.10	13.28	525	4.32
A4	Eggplant	Longo	1.57	475	473	257.3	668.98	32	2.26	2.4	670	7.71
A4	Eggplant	Andrea	2.19	475	473	257.3	668.98	41	2.25	2.6	682	5.83
A12	Pepper	Salvita	0.67	365	921			49	2.18	43.2	591	
A2	Pepper	Niva	2.35	410	597	152.9	397.54	37	2.4	60.8	531	
A3	Pepper	Nassau	2.38	675	382	67.9	176.54	38	3.23	74.1	525	6.25
B1	Pepper	Sirtaki	1.17	95	1173			28	2.78	75	442	
B4	Pepper	Polka	1.52	555	3485			40	2.44	57.9	493	
C4	Pepper	Sirtaki	1.02	176		160.2	416.52	14	2.49	44.6	575	
B2	Tomato	Beril	5.01	250	8434	151.6	394.16	29	3.42	18.6	296	
A11	Tomato	Beril	4.51	325	3230	86.7	225.42	23	3.16	17.9	333	
A14	Tomato	73-33	4.63	285	5288	122.2	317.72	46	3.14	22	275	
A5	Tomato	73-33	5	350	6685	221.8	576.68	33	3.35	23.1	274	5.39

Table 1.2. Fertilisation management (kg/ha) in TADC for the spring planting season 2001.

Greenhouse No.	Species	Variety	Date (yy-mm-dd)	Type	Amount kg	% N	kg N per ha	% P_2O_5	kg P_2O_5 per ha	% K_20	kg K_2O per ha	% S	kg S per ha
A2	Pepper	Niva	12-3-01	Organic manure	4m³								
			25-3-01	$(NH_4)_2HPO_4$	12.5	18	42.2	46	107.8		0		0
			26-4-01	Carbamide	12.5	46.3	108.5		0		0		0
			15-5-01	$(NH_4)_2PO_4$	7.5	18	25.3	46	64.7		0		0
				Multi-fertiliser	7.5	15	21.1	15	21.1	15	21.1	15	21.1
			6-6-01	KCl	2.5		0		0	60	28.1		0
				Multi-fertiliser	10	15	28.1	15	28.1	15	28.1	15	28.1
				$Ca(NO_3)_2$	1.5	12	3.4		0		0		0
			19-6-01	KCl	2.5		0		0	60	28.1		0
				Multi-fertiliser	7.5	15	21.1	15	21.1	15	21.1	15	21.1
A3	Pepper	Nassau		Organic manure	3m³								
			25-3-01	$(NH_4)_2PO_4$	12.5	18	42.2	46	107.8		0		0
			14-4-01	Multi-fertiliser	6	15	16.9	15	16.9	15	16.9	15	16.9
				OA organic-fert	0.5	15	1.4	15	1.4	15	1.4	15	1.4
				Carbamide	6	46.3	52.1		0		0		0
			19-4-01	Multi-fertiliser	6	15	16.9	15	16.9	15	16.9	15	16.9
				OA organic-fert	0.5	15	1.4	15	1.4	15	1.4	15	1.4
				Carbamide	6	46.3	52.1		0		0		0
			26-4-01	Multi-fertiliser	1.5	15	4.2	15	4.2	15	4.2	15	4.2
				Carbamide	1.5	46.3	13.0		0		0		0
			8-5-01	Carbamide	3.5	46.3	30.4		0		0		0
				$(NH_4)_2PO_4$	3.5	18	11.8	46	30.2		0		0
A4	Eggplant	Andrea	15-3-01	Organic manure	4m³								
		and	25-3-01	$(NH_4)_2PO_4$	12.5	18	42.2	46	107.8		0		0
		Longo	11-4-01	Carbamide	20	46.3	173.6		0		0		0
			21-4-01	Multi-fertiliser	24.5		0		0		0		0
				OA organic-fert	0.5	15	1.4	15	1.4	15	1.4	15	1.4
			20-5-01	Carbamide	8	46.3	69.5		0		0		0
				Multi-fertiliser	17	15	47.8	15	47.8	15	47.8	15	47.8
			5-6-01	KCl	2.5		0		0	60	28.1		0
				Multi-fertiliser	10	15	28.1	15	28.1	15	28.1	15	28.1
			18-6-01	KCl	10		0		0	60	112.5		0
				(NH4)2PO4	10	18	33.8	46	86.3		0		0
A5	Tomato	73-33	4-3-01	Organic manure	4m³								
				Multi-fertiliser	12.5	8	18.8	8	18.8	9	21.1		0
			11-4-01	Multi-fertiliser	5	15	14.1	15	14.1	15	14.1	15	14.1
				Carbamide	5	46.3	43.4		0		0		0
				OA organic-fert	0.5	15	1.4	15	1.4	15	1.4	15	1.4
			3-5-01	$(NH_4)_2PO_4$	20	18	67.5	46	172.5		0		0
			28-5-01	Carbamide		46.3	0		0		0		0
			5-6-01	KCl	2.5		0		0	60	28.1		0
				Multi-fertiliser	10	15	28.1	15	28.1	15	28.1	15	28.1
			19-6-01	Carbimide	10	46.3	86.8		0		0		0

Greenhouse No.	Species	Variety	Date (yy-mm-dd)	Type	Amount kg	% N	kg N per ha	% P_2O_5	kg P_2O_5 per ha	% K_20	kg K_2O per ha	% S	kg S per ha
A6	Cucumber	Deltstar	7-3-01	Organic manure	3m³								
			9-3-01	$(NH_4)_2PO_4$	7	18	50.6	46	129.4		0		0
			30-3-01	Multi-fertiliser	3	8	9	8	9	9	10.1		0
			11-4-01	Carbamide	7	46.3	130.2		0		0		0
				OA organic-fert	0	15	4.2	15	4.2	15	4.2	15	42.2
				Multi-fertiliser	7	15	42.2	15	42.2	15	42.2	15	42.2
			28-4-01	Carbamide	1	46.3	26.0		0		0		0
				Multi-fertiliser	1	15	5.6	15	5.6	15	5.6	15	5.6
			10-5-01	Carbamide	2	46.3	43.4		0		0		0
			11-6-01	KCl	1		0		0	60	36		0
				$(NH_4)_2PO_4$	0	18	5.4	46	13.8		0		0
				Carbamide	1	46.3	20.8		0		0		0
			13-6-01	KCl	6		0		0	60	135		0
				$(NH_4)_2PO_4$	3	18	20.3	46	51.8		0		0
				Carbamide	4	46.3	78.1		0		0		0
			19-6-01	KCl	2		0		0	60	54		0
				$(NH_4)_2PO_4$	1	18	8.1	46	20.7		0		0
				Carbamide	1	46.3	31.3		0		0		0
A11	Tomato	Beril	5-3-01	Organic manure	4m³								
				Multi-fertiliser	12	8	18.8	8	18.8	9	21.1		0
			3-4-01	Carbamide	17	46.3	151.9		0		0		0
			24-4-01	Carbamide	5	46.3	43.4		0		0		0
				$(NH_4)_2PO_4$	12	18	42.2	46	107.8		0		0
			13-5-01	Multi-fertiliser	10	15	28.1	15	28.1	15	28.1	15	28.1
				(NH4)2PO4	12	18	42.2	46	107.8		0		0
			30-5-01	Carbamide	15	46.3	130.2		0		0		0
			4-6-01	Carbamide	10	46.3	86.8		0		0		0
				KCl	10		0		0	60	112.5		0
			11-6-01	Carbamide	15	46.3	130.2		0		0		0
A12	Pepper	Salvita	11-3-01	Organic manure	4m³								
			24-3-01	$(NH_4)_2PO_4$	12	18	42.2	46	107.8		0		0
			16-5-01	$(NH_4)_2PO_4$	15	18	50.6	46	129.8		0		0
				Multi-fertiliser	10	15	28.1	15	28.1	15	28.1	15	28.1
			21-6-01	$(NH_4)_2PO_4$	15	18	50.6	46	129.4		0		0
			7/45	$(NH_4)_2PO_4$	5	18	16.9	46	43.1		0		0
				KCl	5		0		0	60	56.3		0

Greenhouse No.	Species	Variety	Date (yy-mm-dd)	Type	Amount kg	% N	kg N per ha	% P_2O_5	kg P_2O_5 per ha	% K_20	kg K_2O per ha	% S	kg S per ha
A14	Tomato	73-33	5-3-01	Organic manure	3.5m³								
				Multi-fertiliser	12.5	8	18.8	8	18.8	9	21.1		0
			1-4-01	Carbamide	15	46.3	130.2		0		0		0
			10-5-01	$Ca(NO_3)_2$	0.15	12	0.3		0		0		0
			17-5-01	Multi-fertiliser	15	8	22.5	8	22.5	9	25.3		0
B1	Pepper	Sartaki	18-3-01	Organic-fertiliser	850	1.26	267.8	1.31	278.4	0.86	182.8		0
			25-3-01	$(NH_4)_2PO_4$	10	18	45	46	115		0		0
			27-5-01	organic-fertiliser			0		0		0		0
			13-6-01	$Ca(NO_3)_2$	0.06	12	0.2		0		0		0
			25-6-01	$(NH_4)_2PO_4$	10	18	45	46	115		0		0
			15-7-01	Boron	0.02		0		0		0		0
B2	Tomato	Berli	4-3-01	Organic manure	3m³								
				Multi-fertiliser	10	8	20	8	20	9	22.5		0
			4-5-01	$(NH_4)_2PO_4$	15	18	67.5	46	172.5		0		0
			20-5-01	$(NH_4)_2PO_4$	7.5	18	33.8	46	86.3		0		0
				Multi-fertiliser	7.5	15	28.1	15	28.1	15	28.125	15	28.1
			12-6-01	Multi-fertiliser	7.5	15	28.1	15	28.1	15	28.125		0
B4	Pepper	Polka	18-3-01	Organic manure	3m³								
			24-3-01	$(NH_4)_2PO_4$	10	18	45	46	115		0		0
			25-4-01	Carbamide	17.5	46.3	202.6		0		0		0
			1-6-01	Multi-fertiliser	10	15	37.5	15	37.5	15	37.5	15	37.5
			6-6-01	Multi-fertiliser	7.5	8	15	8	15	9	16.9		0
				KCl	2.5		0		0	60	37.5		0
				$Ca(NO_3)_2$	0.5	12	1.5		0		0		0
C4	Pepper	Sartaki	17-3-01	Organic manure	1.5m³								
			23-3-01	Multi-fertiliser	2	8	12	8	12	9	13.5		0
			30-4-01	Carbamide	4	46.3	138.9		0		0		0
				Multi-fertiliser	4	15	45	15	45	15	45	15	45
			21-5-01	$Ca(NO_3)_2$	0.03	12	0.3		0		0		0

Table 1.3. Fertiliser application in each greenhouse of TADC; organic (considering 50% DM). chemical and total N-P-K input.

Greenhouse			kg N/ha			kg P_2O_5/ha			kg K_2O/ha			kg S/ha
No.	Species	Variety	Organic manure	Chemicals total input	Total N-input	Organic manure	Chemicals total input	Total P_2O_5-input	Organic manure	Chemicals total input	Total K_2O-input	Total S-input
A6	Cucumber	Deltstar	708.8	475.3	1184.0	736.9	276.7	1013.5	483.8	287.2	770.9	52.0
A4	Eggplant	Andrea	472.5	396.4	868.9	491.3	271.4	762.7	322.5	218.0	540.5	77.3
	Eggplant	Longo	472.5	396.4	868.9	491.3	271.4	762.7	322.5	218.0	540.5	79.3
A12	Pepper	Salvita	472.5	188.4	660.9	491.3	437.8	929.1	322.5	84.4	406.9	28.1
A2	Pepper	Niva	472.5	249.7	722.2	491.3	242.8	734.1	322.5	126.6	449.1	70.3
A3	Pepper	Nassau	472.5	242.4	714.9	491.3	178.8	670.0	322.5	40.8	363.3	40.8
B1	Pepper	Sirtaki	133.9	90.2	224.1	139.2	0.0	139.2	91.4	0.0	91.4	0.0
B4	Pepper	Polka	472.5	301.6	774.1	491.3	167.5	658.8	322.5	91.9	414.4	37.5
C4	Pepper	Sirtaki	708.8	196.2	904.9	736.9	57.0	793.9	483.8	58.5	542.3	45.0
B2	Tomato	Beril	472.5	177.5	650.0	491.3	335.0	826.3	322.5	78.8	401.3	28.1
A11	Tomato	Beril	472.5	673.8	1146.3	491.3	262.5	753.8	322.5	161.7	484.2	28.1
A14	Tomato	73-33	413.4	171.8	585.2	429.8	41.3	471.1	282.2	46.4	328.6	0.0
A5	Tomato	73-33	472.5	260.1	732.6	491.3	234.8	726.1	322.5	92.8	415.3	43.6

Table 1.4. Crop protection management (g/mu and g/ha) in TADC for the spring season 2001.

Greenhouse No.	Species	Variety	Area (mu)	Date (yy-mm-dd)	Type	Amount	g/mu	g/ha	Specification
B1	Pepper	Sirtaki	0.65		TAOXIAO	5 ml	1.54	23.1	20%
			0.65	2001.4.4	Imidacloprid	5 ml	0.19	2.9	2.50%
			0.65	2001.4.14	Abamectin	20 ml	0.15	2.3	0.50%
			0.65	2001.5.26	Cypermethrin	20 ml	4.92	73.8	16%
			0.65		Nonglianmaysu	14 g	15.51	232.6	72%
			0.65	2001.6.13	Sandofan	50 g	49.23	738.5	64%
			0.65	2001.6.23	Agrimec	20 ml	0.55	8.3	1.80%
			0.65	2001.7.2	TAOXIAO	20 ml	6.15	92.3	20%
				TOTAL			78.25	1173.8	
B2	Tomato	Beril	0.65		TAOXIAO	15 ml	4.6	69.2	20%
			0.65	2001.3.16	Iprodione	100 g	76.9	1153.8	50%
			0.65	2001.4.4	Iprodione	100 g	76.9	1153.8	50%
			0.65	2001.4.12	Topsin-m	100 g	107.7	1615.4	70%
			0.65	2001.4.21	Topsin-m	200 g	215.4	3230.8	70%
			0.65	2001.4.30	Topsin-m	75 g	80.8	1211.5	70%
				TOTAL			562.3	8434.6	
B4	Pepper	Polka	0.65		TAOXIAO	5 ml	1.5	23.1	20%
			0.65	2001.4.4	Imidacloprid	10 ml	0.4	5.8	2.50%
			0.65	2001.4.28	NONGLIANMAYSU	66 g	73.1	1096.6	72%
			0.65	2001.5.29	Imidacloprid	24 ml	0.9	13.8	2.50%
			0.65	2001.6.1	Sandofan	50 g	49.2	738.5	64%
			0.65	2001.6.23	Sandofan	50 g	49.2	738.5	64%
			0.65	2001.6.30	TAOXIAO	20 ml	6.2	92.3	20%
			0.65	2001.7.13	Sandofan	20 g	19.7	295.4	64%
			0.65		NONGLIANMAYSU	14 g	15.5	232.6	72%
			0.65	2001.7.25	NONGLIANMAYSU	15 g	16.6	249.2	72%
				TOTAL			232.4	3485.8	
A2	Pepper	Niva	0.8	2001.3.1	Imidacloprid	50 ml	1.6	23.4	2.50%
			0.8	2001.5.1	NONGLIANMAYSU	42 g	37.8	567.0	72%
			0.8	2001.5.1	Abamectin	20 g	0.5	6.8	1.80%
				TOTAL			39.8	597.2	
A3	Pepper	Nasau	0.8	2001.3.1	Imidacloprid	50 ml	1.6	23.4	2.50%
			0.8	2001.4.11	Agrimec	50 ml	1.1	16.9	1.80%
			0.8	2001.4.20	Meothrin	25 ml	6.3	93.8	20.00%
			0.8	2001.5.14	Cypermethrin	10 ml	2.0	30.0	16%
			0.8	2001.5.19	Imidacloprid	25 ml	0.8	11.7	2.50%
			0.8	2001.5.31	Actara	24 g	7.5	112.5	25%
			0.8	2001.6.4	Actara	16 g	5.0	75.0	25%
			0.8	2001.7.18	TAOXIAO	5 ml	1.3	18.8	20%
				TOTAL			25.5	382.0	

Greenhouse No.	Species	Variety	Area (mu)	Date	Type	Amount	g/mu	g/ha	Specification
A4	Eggplant	Longo/	0.8		Actara	4 g	1.25	18.8	25%
		Andrea	0.8	2001.4.2	Imidacloprid	18 ml	0.5625	8.4	2.50%
			0.8	2001.4.2	Imidacloprid	50 ml	1.5625	23.4	2.50%
			0.8	2001.5.7	Imidacloprid	50 ml	1.5625	23.4	2.50%
			0.8	2001.5.15	Actara	25 g	7.5	112.5	25%
			0.8	2001.6.3	Agrimec	50 ml	1.125	16.9	1.80%
			0.8	2001.6.25	TAOXIAO	60 ml	15	225.0	20%
			0.8	2001.7.3	Imidacloprid	96 ml	3	45.0	2.50%
				TOTAL			31.5625	473.4	
A5	Tomato	73-33	0.8		TAOXIAO	5 g	1.25	18.8	20%
			0.8	2001.3.16	HUIMAYWEI	30 g	16.875	253.1	45%
			0.8	2001.3.28	HUIMAYWEI	45 g	25.3125	379.7	45%
			0.8	2001.4.3	HUIMAYWEI	100 g	56.25	843.8	45%
			0.8	2001.4.6	Talstar	30 ml	3.75	56.3	10%
			0.8	2001.4.17	Applaud	40 g	12.5	187.5	25%
			0.8		Iprodione	75 g	70.3125	1054.7	75%
			0.8		Talstar	10 ml	1.25	18.8	10%
			0.8	2001.4.18	Applaud	8 g	2.5	37.5	25%
			0.8		Daconil	25 g	23.4375	351.6	75%
			0.8		Toposin		0	0.0	
			0.8	2001.4.21	Topsin	120 g	112.5	1687.5	75%
			0.8	2001.4.28	Topsin	120 g	112.5	1687.5	75%
			0.8	2001.5.11	Imidacloprid	50 ml	1.5625	23.4	2.50%
			0.8	200.5.29	Actara	18 g	5.625	84.4	25%
				TOTAL			445.625	6684.4	
A6	Cucumber	Deltastar	0.4		Iprodione	35 g	43.75	656.3	50%
			0.4	2001.3.16	Actara	6 g	3.75	56.3	25%
			0.4	2001.3.28	Daconil	25 g	31.25	468.8	50%
			0.4	2001.4.3	Applaud	25 g	15.625	234.4	25%
			0.4	2001.4.20	Cypermethrin	20 ml	8	120.0	16%
			0.4	2001.5.13	Actara	4 g	2.5	37.5	25%
			0.4	2001.5.28	Actara	30 g	18.75	281.3	25%
			0.4	2001.6.5	Actara	16 g	10	150.0	25%
			0.4	2001.6.23	YINGMANGJING	50 ml	1.25	18.8	1%
				TOTAL			134.875	2023.1	

Greenhouse No.	Species	Variety	Area (mu)	Date	Type	Amount	g/mu	g/ha	Specification
A11	Tomato	Beril	0.8		TAOXIAO	5 ml	1.25	18.8	20%
			0.8	2001.3.16	Iprodione	30 g	18.75	281.3	50%
			0.8	2001.3.30	Iprodione	30 g	18.75	281.3	50%
			0.8	2001.4.1	Iprodione	30 g	18.75	281.3	50%
			0.8	2001.4.11	Daconil	75 g	70.3125	1054.7	75%
			0.8	2001.4.16	Topsin-m	100 g	87.5	1312.5	70%
				TOTAL			215.3125	3229.7	
A12	Pepper	Salvita	0.8		Imidacloprid	14 ml	0.4375	6.6	3%
			0.8	2001.4.24	Agrimec	30 ml	0.675	10.1	1.80%
			0.8	2001.5.27	Imidicloprid	30 ml	0.9375	14.1	2.50%
			0.8		Imidicloprid	25 ml	0.78125	11.7	2.50%
			0.8	2001.6.8	NONGLIANMAYSHU	14 g	12.6	189.0	72%
			0.8	200.6.18	NONGLIANMAYSHU	19 g	17.1	256.5	72%
			0.8	2001.7.7	Agrimec	80 ml	1.8	27.0	1.80%
			0.8		NONGLIANMAYSHU	19 g	17.1	256.5	72%
			0.8	2001.7.15	TAOXIAO	40 ml	10	150.0	20%
				TOTAL			61.43125	921.5	
A14	Tomato	73-33	0.8		TAOXIAO	5 ml	1.25	18.8	20%
			0.8	2001.3.16	Iprodione	100 g	62.5	937.5	50%
			0.8	200.4.10	Abamectin	32 g	8	120.0	20%
			0.8	2001.4.14	Daconil	100 g	93.75	1406.3	75%
			0.8	2001.4.18	Topsin-m	100 g	87.5	1312.5	70%
			0.8	2001.4.20	TAOXIAO	48 ml	12	180.0	20%
			0.8	2001.5.28	Topsin-m	100 g	87.5	1312.5	70%
				TOTAL			352.5	5287.5	

Table 1.5. Irrigation management (mm) in TADC for the spring planting season 2001.

Date	Pepper A2	Pepper A3	Eggplant A4	Tomato A5	Cucumber A6	Tomato A11	Pepper A12	Tomato A14	Pepper B1	Tomato B2	Pepper B4	Pepper C4
4-march				4						3		
5-march						5		4				
6-march						6						
7-march				19		15				21		
8-march				23				34		5		
9-march					50			33				
10-march					29							
15-march						24						
24-march							5				6	
25-march	6	7	18					28	8			
26-march	37	44	93				36				5	
27-march	36	32	97				5		9		22	
30-march					63				7			
31-march					225							
1-apr								36				
3-apr						52						
4-apr						19						
10-apr	19						24					
11-apr	44		191	48	10		16				12	
12-apr	19	24		37	5						52	
21-apr			46									
22-apr			21									
24-apr						34						
25-apr	37	15				17					47	
26-apr		24					45				32	
28-apr					49							7
2-may								39				5
3-may				29								
4-may				55								
9-may		52								3		
10-may		22			78							
11-may					29							
12-may			5									
13-may			16			34				1		124
15-may	15									45	21	
16-may	34	38					15				52	
17-may	11	16		11			35	56				
18-may				9								
20-may			13							43		
21-may			16								3	
22-may		24	30			39		4				
23-may	11											
24-may	16						13.5					
26-may							7		19			
28-may				7	27				12			
29-may		3		12	17							
30-may			5	5		28						
31-may	15											

Date	Pepper A2	Pepper A3	Eggplant A4	Tomato A5	Cucumber A6	Tomato A11	Pepper A12	Tomato A14	Pepper B1	Tomato B2	Pepper B4	Pepper C4
3-jun		34									39	
4-jun						33						
5-jun			3	27								
6-jun	29						51				5	
7-jun	2		37		7						11	
8-jun		26									16	
9-jun					6							96
11-jun					5	22						
13-jun					63					9		
15-jun		30										
18-jun			69					26				
19-jun	35			29	15						16	
21-jun					15	32					25	8
27-jun		23							42			
29-jun					5							
6-jul	11											
9-jul			22								8	8
10-jul			65									
11-jul		68									16	
13-jul	13										25	
14-jul		32										
15-jul	7						82					
19-jul					73							
20-jul	5											
22-jul	12		57									
26-jul		14										
29-jul		39										48
2-aug		22										
3-aug			32								66	
11-aug		64										

Table 1.6. General data in Liu Fu and average inputs and outputs of each greenhouse for the spring planting season 2001.

Greenhouse No.	Species	Variety	Area (mu)	Area (m^2)	Planting date	End date	Number of plants	per mu	per m^2	First harvest date	Last harvest date	Total fertilisers (kg/ha) (excluding organic manure) N-input	P_2O_5-input	K_2O-input
8	Eggplant	Longo	0.83	552.5	13-4-01	2-9-01	1120	1352	2.03	28-6-01	21-8-01	845	679	679
7	Eggplant	Longo	0.83	552.5	13-4-01	5-9-01	1120	1352	2.03	28-6-01	1-9-01	845	679	679
6	Eggplant	Longo	0.83	552.5	13-4-01	1-9-01	1120	1352	2.03	28-6-01	9-7-01	845	679	679
16	Eggplant	Longo	0.86	576	13-4-01		1372	1589	2.38	1-7-01		811	651	651
14	Eggplant	Andrea	0.86	576	13-4-01		1372	1589	2.38	12-6-01	16-7-01	811	651	651
15	Eggplant	Andrea	0.86	576	13-4-01		1372	1589	2.38	12-6-01	16-7-01	811	651	651
17	Eggplant	Andrea	0.65	432	16-4-01		1008	1556	2.33	6-6-01	16-7-01	1081	868	868
18	Eggplant	Andrea	0.65	432	16-4-01		1008	1556	2.33	6-6-01	16-7-01	1081	868	868
19	Eggplant	Andrea	0.65	432	16-4-01		1008	1556	2.33	6-6-01	16-7-01	1081	868	868
20	Eggplant	Andrea	0.65	432	16-4-01		1008	1556	2.33	6-6-01	16-7-01	1081	868	868
4	Pepper	Sirtaki	0.83	552.5	4-4-01		1144	1381	2.07	22-6-01	9-7-01	845	679	679
5	Pepper	Sirtaki	0.83	552.5	4-4-01		1144	1381	2.07	23-6-01		845	679	679
10	Pepper	Sirtaki	0.86	576	3-4-01		1484	1718	2.58	27-6-01	9-7-01	811	651	651
13	Pepper	Sirtaki	0.86	576	4-4-01		1484	1718	2.58	25-6-01		811	651	651
11	Pepper	Niva	0.86	576	4-4-01		1484	1718	2.58	26-6-01	3-7-01	811	651	651
12	Pepper	Nassau	0.86	576	4-4-01		1484	1718	2.58	7-6-01	24-6-01	811	651	651
3 N	Tomato	Beril	0.78	520	7-3-01	14-7-01	1638	2101	3.15	15-6-01	8-7-01	0	0	0
10 N	Tomato	Beril	0.78	520	6-3-01	14-7-01	1638	2101	3.15	15-6-01	8-7-01	0	0	0
15 N	Tomato	Beril	0.78	520	7-3-01	14-7-01	1638	2101	3.15	15-6-01	8-7-01	0	0	0
3 S	Tomato	Beril	0.78	520	5-3-01	13-7-01	1638	2101	3.15	8-6-01	8-7-01	0	0	0
4 S	Tomato	Beril	0.78	520	6-3-01	13-7-01	1638	2101	3.15	15-6-01	8-7-01	0	0	0
10 S	Tomato	Beril	0.78	520	5-3-01	13-7-01	1638	2101	3.15	15-6-01	8-7-01	0	0	0
12 S	Tomato	Beril	0.78	520	5-3-01	13-7-01	1638	2101	3.15	15-6-01	8-7-01	0	0	0
S 0	Tomato	73-33 Katerina	3.99	2664	18-3-01	16-7-01	11200	2804	4.20	15-5-01	8-7-01	0	0	0
7 N	Tomato	72-68	0.78	520	4-3-01	14-7-01	1638	2101	3.15	4-6-01	8-7-01	0	0	0
1 S	Cucumber	Deltastar	0.78	520	22-2-01	30-5-01	1638	2101	3.15	29-3-01	29-5-01	1064	0	0
5 S	Cucumber	Deltastar	0.78	520	22-2-01	30-5-01	1638	2101	3.15	29-3-01	29-5-01	893	0	0
7 S	Cucumber	Deltastar	0.78	520	23-2-01	30-5-01	1638	2101	3.15	31-3-01	28-5-01	887	0	0
9 S	Cucumber	Deltastar	0.78	520	23-2-01	30-5-01	1638	2101	3.15	31-3-01	28-5-01	1033	0	0
11 S	Cucumber	Deltastar	0.78	520	23-2-01	30-5-01	1638	2101	3.15	31-3-01	29-5-01	742	0	0

			Yield	Water	Pesticides	Price		Soil		Products analysis results			
Greenhouse				total	total	Yuans	Yuans per	$N0_3$-N	$N_{(20\ cm)}$	%	VitC	Nitrate	DM
No.	Species	Variety	kg/m²	mm	kg/ha		pound	mg/kg	(kg/ha)	sugar	mg/100g	mg/kg	(%)
8	Eggplant	Longo	0.75	814	0	197	0.24						
7	Eggplant	Longo	1.02	814	0	304	0.27						
6	Eggplant	Longo	0.54	814	0	313	0.52			2.63	2.71	620.5	7.82
16	Eggplant	Longo	0.14	781	0	36.8	0.23			2.97	3.26	724.3	
14	Eggplant	Andrea	0.65	781	0	59.8	0.08						
15	Eggplant	Andrea	0.52	781	0	49	0.08						
17	Eggplant	Andrea	0.67	1042	0	44	0.08						
18	Eggplant	Andrea	0.67	1042	0	44	0.08	22.4	58				
19	Eggplant	Andrea	0.67	1042	0	44	0.08						
20	Eggplant	Andrea	0.67	1042	0	44	0.08						
4	Pepper	Sirtaki	0.68	814	0	232	0.31	3.8	10	3.86	117.8	630.3	
5	Pepper	Sirtaki	0.02	814	0	12	0.60						
10	Pepper	Sirtaki	0.08	781	0	49	0.52	10.6	28				
13	Pepper	Sirtaki	0.01	868	0	9	0.60						
11	Pepper	Niva	0.08	781	0	49	0.52			3.17	93.1	454.8	6.04
12	Pepper	Nassau	0.02	781	0	15	0.60			4.08	116	579.4	
3 N	Tomato	Beril	6.31	1298	2.981	1338	0.20	143.8	374	2.36	13.4	184.7	
10 N	Tomato	Beril	5.75	1298	1.923	1183.5	0.20	134.6	350	2.66	13.9	332.2	
15 N	Tomato	Beril	5.73	1298	2.308	1180	0.20	117.5	306	2.4	15.7	210.8	
3 S	Tomato	Beril	6.31??	1442	1.923	1563	0.24	81.6	212	2.85	16.7	213	5.67
4 S	Tomato	Beril	4.49	1442	0.962	1109	0.24	18.9	49	2.88	16.1	169	
10 S	Tomato	Beril	5.06	1442	1.346	1261	0.24	59.8	155	2.56	15.2	216.3	
12 S	Tomato	Beril	4.59	1442	1.346	1118	0.23	46.2	120	2.5	15.2	192.4	
S 0	Tomato	73-33 Katerina	3.22	768	0.562	4096	0.24	32.4	84	2.69	17.3	238	
7 N	Tomato	72-68	3.63	577	1.346	789	0.21	5.3	14	4.84	17.8	236.1	
1 S	Cucumber	Deltastar	1.96	1683	10.452	3154.2	1.55	0	0	2.37	13.3	561.6	
5 S	Cucumber	Deltastar	2.68	1731	7.423	3969.4	1.43	9.6	25	2.41	13	547	
7 S	Cucumber	Deltastar	2.35	1779	9.394	3154.2	1.29	224.6	584	2.25	14	470.4	
9 S	Cucumber	Deltastar	2.46	1923	9.971	3391.1	1.33	135.6	353	2.4	15.0	483.2	
11 S	Cucumber	Deltastar	2.78	1490	9.394	4002.6	1.38	18.9	49	2.84	18.9	581.1	5.44

Table 1.7. Fertilisation management (pounds/mu and kg/ha) in Liu Fu for the spring season 2001.

Greenhouse No.	Sp., Var.	Date	Type	Pounds	% N	Pounds N per mu	kg N per ha	% P_2O_5	Pounds P_2O_5 / mu	kg P_2O_5 per ha	% K_20	Pounds K_2O / mu	kg K_2O per ha
8	Eggplant,	8-4-01	compound fertiliser	500	15	90.5	678.7	15.0	90.5	678.7	15.0	90.5	678.7
	Longo	20-5-01	urea	20	46	11.1	83.3		0.0	0.0		0.0	0.0
		5-6-01	urea	20	46	11.1	83.3		0.0	0.0		0.0	0.0
7	Eggplant,	8-4-01	compound fertiliser	500	15	90.5	678.7	15.0	90.5	678.7	15.0	90.5	678.7
	Longo	20-5-01	urea	20	46	11.1	83.3		0.0	0.0		0.0	0.0
		5-6-01	urea	20	46	11.1	83.3		0.0	0.0		0.0	0.0
6	Eggplant,	8-4-01	compound fertiliser	500	15	90.5	678.7	15.0	90.5	678.7	15.0	90.5	678.7
	Longo	19-5-01	urea	20	46	11.1	83.3		0.0	0.0		0.0	0.0
		5-6-01	urea	20	46	11.1	83.3		0.0	0.0		0.0	0.0
14	Eggplant,	8-4-01	compound fertiliser	500	15	86.8	651.0	15.0	86.8	651.0	15.0	86.8	651.0
	Andrea	19-5-01	urea	20	46	10.7	79.9		0.0	0.0		0.0	0.0
		5-6-01	urea	20	46	10.7	79.9		0.0	0.0		0.0	0.0
15	Eggplant,	8-4-01	compound fertiliser	500	15	86.8	651.0	15.0	86.8	651.0	15.0	86.8	651.0
	Andrea	19-5-01	urea	20	46	10.7	79.9		0.0	0.0		0.0	0.0
		5-6-01	urea	20	46	10.7	79.9		0.0	0.0		0.0	0.0
16	Eggplant,	8-4-01	compound fertiliser	500	15	86.8	651.0	15.0	86.8	651.0	15.0	86.8	651.0
	Andrea	19-5-01	urea	20	46	10.7	79.9		0.0	0.0		0.0	0.0
		5-6-01	urea	20	46	10.7	79.9		0.0	0.0		0.0	0.0
17	Eggplant,	8-4-01	compound fertiliser	500	15	115.8	868.1	15.0	115.8	868.1	15.0	115.8	868.1
	Andrea	21-5-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
		7-6-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
18	Eggplant,	8-4-01	compound fertiliser	500	15	115.8	868.1	15.0	115.8	868.1	15.0	115.8	868.1
	Andrea	21-5-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
		7-6-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
19	Eggplant,	8-4-01	compound fertiliser	500	15	115.8	868.1	15.0	115.8	868.1	15.0	115.8	868.1
	Andrea	21-5-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
		7-6-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
20	Eggplant,	8-4-01	compound fertiliser	500	15	115.8	868.1	15.0	115.8	868.1	15.0	115.8	868.1
	Andrea	21-5-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
		7-6-01	urea	20	46	14.2	106.5		0.0	0.0		0.0	0.0
1 S	Cucumber,	20-3-01	urea	16	46	9.4	70.8						
	Deltastar	15-3-01	potasium phosphate	0.2	55	0.1	1.1						
		1-4-01	urea	20	46	11.8	88.5						
		11-4-01	compound fert.	24	63	19.4	145.4						
		16-4-01	compound fert.	24	63	19.4	145.4						
		22-4-01	compound fert.	24	63	19.4	145.4						
		30-4-01	compound fert.	24	63	19.4	145.4						
		7-5-01	compound fert.	24	63	19.4	145.4						
		21-5-01	urea	20	46	11.8	88.5						
		28-5-01	urea	20	46	11.8	88.5						

Greenhouse No.	Sp., Var.	Date	Type	Pounds	% N	Pounds N per mu	kg N per ha	% P_2O_5	Pounds P_2O_5 / mu	kg P_2O_5 per ha	% K_20	Pounds K_2O / mu	kg K_2O per ha
11 S	Cucumber,	16-3-01	urea	16	46	9.4	70.8						
	Deltastar	21-3-01	potasium phosphate	0.2	55	0.1	1.1						
		2-4-01	urea	20	46	11.8	88.5						
		12-4-01	compound fert.	24	63	19.4	145.4						
		22-4-01	fertiliser	24	63	19.4	145.4						
		30-4-01	compound fert.	24	63	19.4	145.4						
		6-5-01	compound fert.	24	63	19.4	145.4						
5 S	Cucumber,	20-3-01	urea	16	46	9.4	70.8						
	Deltastar	15-3-01	potasium phosphate	0.2	55	0.1	1.1						
		1-4-01	urea	20	46	11.8	88.5						
		11-4-01	compound fert.	24	63	19.4	145.4						
		22-4-01	fertiliser	25	63	20.2	151.4						
		29-4-01	compound fert.	24	63	19.4	145.4						
		2-5-01	compound fert.	24	63	19.4	145.4						
		9-5-01	compound fert.	24	63	19.4	145.4						
7 S	Cucumber,	20-3-01	urea	16	46	9.4	70.8						
	Deltastar	15-3-01	potasium phosphate	0.2	55	0.1	1.1						
		2-4-01	urea	20	46	11.8	88.5						
		12-4-01	compound fertiliser	24	63	19.4	145.4						
		22-4-01	fertiliser	24	63	19.4	145.4						
		29-4-01	compound fertiliser	24	63	19.4	145.4						
		2-5-01	compound fertiliser	24	63	19.4	145.4						
		8-5-01	compound fertiliser	24	63	19.4	145.4						
9 S	Cucumber,	20-3-01	urea	16	46	9.4	70.8						
	Deltastar	15-3-01	potasium phosphate	0.2	55	0.1	1.1						
		2-4-01	urea	20	46	11.8	88.5						
		12-4-01	compound fertiliser	24	63	19.4	145.4						
		22-4-01	fertiliser	24	63	19.4	145.4						
		26-4-01	compound fertiliser	24	63	19.4	145.4						
		29-4-01	compound fertiliser	24	63	19.4	145.4						
		2-5-01	compound fertiliser	24	63	19.4	145.4						
		8-5-01	compound fertiliser	24	63	19.4	145.4						

Table 1.8. Crop protection management (g/mu and g/ha) in Liu Fu for the spring planting season 2001.

Greenhouse No.	Sp., Var.	Date	Type	Amount (g) (ml)	g/mu	g/ha	Specification
3 N	Tomato, Beril	28-3-01	菌必治	100	128.3	1634.6	85%
		15-4-01	代森锰锌	100	128.3	1346.2	70%
7 N	Tomato, 72-68	28-3-01	代森锰锌	100	128.3	1346.2	70%
10 N	Tomato, Beril	28-3-01	菌必治	100	128.3	961.5	50%
		2-4-01	菌必治	100	128.3	961.5	50%
15 N	Tomato, Beril	28-3-01	菌必治	100	128.3	961.5	50%
		15-4-01	代森锰锌	100	128.3	1346.2	70%
1 S	Cucumber,	3-3-01	疫双灵	100	128.3	1634.6	85%
	Deltastar	10-3-01	代森锰锌	105	134.7	1413.5	70%
		15-3-01	疫双灵	100	128.3	1634.6	85%
		26-3-01	一遍净	20	25.7	38.5	10%
		1-4-01	一遍净	20	25.7	38.5	10%
		8-4-01	代森锰锌	100	128.3	1346.2	70%
		12-4-01	疫双灵	100	128.3	1634.6	85%
			一遍净	10	12.8	19.2	10%
		18-4-01	代森锰锌	100	128.3	1346.2	70%
		25-5-01	代森锰锌	100	128.3	1346.2	70%
11 S	Cucumber,	5-3-01	疫双灵	100	128.3	1634.6	85%
	Deltastar	11-3-01	代森锰锌	105	134.7	1413.5	70%
		16-3-01	疫双灵	100	128.3	1634.6	85%
		27-3-01	一遍净	20	25.7	38.5	10%
		1-4-01	一遍净	20	25.7	38.5	10%
		6-4-01	代森锰锌	100	128.3	1346.2	70%
		12-4-01	代森锰锌	100	128.3	1346.2	70%
			一遍净	10	12.8	19.2	10%
		20-4-01	杜邦克露	100	128.3	961.5	50%
		4-5-01	粉锈宁	100	128.3	961.5	50%
5 S	Cucumber,	3-3-01	疫双灵	100	128.3	1634.6	85%
	Deltastar	10-3-01	代森锰锌	100	128.3	1346.2	70%
		15-3-01	疫双灵	100	128.3	1634.6	85%
		26-3-01	一遍净	20	25.7	38.5	10%
		1-4-01	一遍净	20	25.7	38.5	10%
		12-4-01	代森锰锌	100	128.3	1346.2	70%
			一遍净	10	12.8	19.2	10%
		27-4-01	代森锰锌	100	128.3	1346.2	70%
			一遍净	10	12.8	19.2	10%
7 S	Cucumber,	3-3-01	疫双灵	100	128.3	1634.6	85%
	Deltastar	10-3-01	代森锰锌	105	134.7	1413.5	70%
		15-3-01	疫双灵	100	128.3	1634.6	85%
		26-3-01	一遍净	20	25.7	38.5	10%
		1-4-01	一遍净	20	25.7	38.5	10%
		6-4-01	代森锰锌	100	128.3	1346.2	70%
		12-4-01	代森锰锌	100	128.3	1346.2	70%
			一遍净	10	12.8	19.2	10%
		21-4-01	杜邦克露	100	128.3	961.5	50%
		4-5-01	粉锈宁	100	128.3	961.5	50%

Greenhouse No.	Sp., Var.	Date	Type	Amount (g) (ml)	g/mu	g/ha	Specification
9 S	Cucumber,	3-3-01	疫双灵	100	128.3	1634.6	85%
	Deltastar	10-3-01	代森锰锌	105	134.7	1413.5	70%
		15-3-01	疫双灵	100	128.3	1634.6	85%
		26-3-01	一遍净	20	25.7	38.5	10%
		1-4-01	一遍净	20	25.7	38.5	10%
		6-4-01	代森锰锌	100	128.3	1346.2	70%
		12-4-01	代森锰锌	100	128.3	1346.2	70%
			一遍净	10	12.8	19.2	10%
		21-4-01	杜邦克露	100	128.3	961.5	50%
			绿芬威	50	64.1	576.9	60%
		4-5-01	粉锈宁	100	128.3	961.5	50%
3 S	Tomato, Beril	28-3-01	菌必治	100	128.3	961.5	50%
		24-4-01	杜邦克露	100	128.3	961.5	50%
4 S	Tomato, Beril	28-3-01	菌必治	100	128.3	961.5	50%
10 S	Tomato, Beril	28-3-01	代森锰锌	100	128.3	1346.2	70%
12 S	Tomato. Beril	28-3-01	代森锰锌	100	128.3	1346.2	70%
S 0	Tomato, Beril	22-3-01	爱福丁	150	37.5	281.1	50%
		25-3-01	爱福丁	150	37.5	281.1	50%

Table 1.9. Irrigation management (mm) in Liu Fu for the spring planting season 2001 (25 m³ per hour).

Greenhouse no.	8 E	7 E	6 E	14 E	15 E	16 E	17 E	18 E	19 E	20 E	1 P	2 P	3 P	4 P	5 P	9 P	10 P	11 P	12 P	13 P	3N T	15 N T	7N T	10 N T	1S C	7 S C	9 S C	5 S C	11 S C	4 S T	10 S T	12 S T	3 S T	S 0 T
22-feb																									144	144	144		144					
4-mrc																							144											
6-mrc																								144						144	144	144	144	
7-mrc																					144	144												
15-mrc																									144	144	144	144		144	144	144	144	
18-mrc																																		75
19-mrc																																		75
20-mrc																										144	144	144	144					
25-mrc						87	116	116	116	116	90	90	90	90	90	87	87	87	87	87														
1-apr																									192	192	192	144	192					94
4-apr											90	90	90	90	90	87	87	87	87	87														
6-apr																												144						
11-apr																								192	144	144	144	144					75	
13-apr	90	90	90	87	87	87																												
16-apr							116	116	116	116															144	144								
19-apr											90	90	90	90	90	87	87	87	87	87	144	144						144						
20-apr	90	90	90	87	87	87	116	116	116	116															144		144		144					
25-apr	90	90	90	87	87																						144							75
29-apr											90	90	90	90	90	87	87	87	87	87			144	144										
30-apr	90	90	90	87	87	87	116	116	116	116															144	144	144	144	144	144	144	144	144	
2-may																										144	144	144						
4-may																																		75
6-may																87	87	87	87	87					144	144	144	144	144	144	144	144	144	
8-may																					144	144		144										
11-may							116	116	116	116																								

Greenhouse no.	8	7	6	14	15	16	17	18	19	20	1	2	3	4	5	9	10	11	12	13	3N	15 N	7N	10 N	1S	7 S	9 S	5 S	11 S	4 S	10 S	12 S	3 S	S 0
	E	E	E	E	E	E	E	E	E	E	P	P	P	P	P	P	P	P	P	P	T	T	T	T	C	C	C	C	C	T	T	T	T	T
12-may											90	90	90	90	90																			
13-may	90	90	90	87	87	87																												
16-may																87	87	87	87	87					144	144	144	144	144					
17-may											90	90	90	90	90																			
19-may						87															144	144		144										
20-may	90	90	90	87	87																													
21-may							116	116	116	116															144	144	144	144	144	144	144	144	144	75
23-may																87	87	87	87	87														
25-may											90	90	90	90	90																			
28-may	90	90	90	87	87	87															144	144		144	144	144	144	144	144	144	144	144	144	75
29-may							116	116	116	116																								
31-may																87	87	87	87	87														
3-jun																														144	144	144	144	75
5-jun	90	90	90	87	87	87															144	144		144										
6-jun											90	90	90	90	90																			
7-jun							116	116	116	116																								
8-jun																87	87	87	87	87														
11-jun	90	90	90	87	87	87																								144	144	144	144	75
12-jun							116	116	116	116	90	90	90	90	90						144	144		144										75
18-jun																					144	144	144	144						144	144	144	144	19
26-jun																					144	144	144	144						144	144	144	144	19

(E = eggplant, P = pepper, T = tomato, C = cucumber)

Table 1.10. General data in Dang Cheng and averages on inputs and outputs of each greenhouse for the spring planting season 2001.

Greenhouse			Area		Planting	End	Number of plants			First	Last	Total fertilisers (kg/ha) (excluding organic manure)		
			(mu)	(m^2)	date	date		per mu	per m^2	harvest	harvest			
No.	Species	Variety								date	date	N-input	P_2O_5-inp	K_2O-inpu
3-5	Eggplant	Andrea	0.87	577.6	8-4-01	13-6-01	1664	1922	2.9	2-6-01	12-6-01	198.3	39.0	39.0
1-3	Eggplant	Andrea	0.76	504	8-4-01	20-7-01	1500	1985	3.0	1-6-01	18-7-01	227.3	44.7	44.7
1-11	Eggplant	Andrea	0.76	504	8-4-01	5-7-01	1560	2065	3.1	29-5-01	5-7-01	136.0	89.3	244.2
1-6	Eggplant	Longo	0.76	504	19-4-01	12-7-01	1320	1747	2.6	2-6-01	12-7-01	227.3	44.7	44.7
2-1	Eggplant	Longo	0.88	585.2	20-4-01	28-8-01	1584	1805	2.7	2-6-01	23-8-01	0.0	0.0	0.0
2-7	Tomato	Beril	0.80	532	7-4-01	12-7-01	1560	1956	2.9	15-6-01	9-7-01	41.0	65.0	25.6
2-7	Cherry tom.	72-68	0.08	53.2	18-4-01	31-7-01	156	1956	2.9	15-6-01	15-7-01	41.0	65.0	25.6
2-8	Tomato	Beril	0.64	425.6	7-4-01	12-7-01	1248	1956	2.9	15-6-01	9-7-01	41.0	65.0	25.6
2-8	Cherry tom.	72-68	0.24	159.6	18-4-01	29-7-01	468	1956	2.9	15-6-01	15-7-01	41.0	65.0	25.6
1-2	Tomato	73-33	0.76	504	5-4-01	11-7-01	1500	1985	3.0	15-6-01	10-7-01	0.0	0.0	0.0
2-12	Tomato	73-33	0.88	585.2	8-4-01	3-8-01	1650	1881	2.8	15-6-01	31-7-01	97.5	98.3	355.6
2-6	Tomato	73-33	0.88	585.2	4-4-01	10-7-01	1848	2106	3.2	15-6-01	8-7-01	25.6	25.6	25.6
2-9	Tomato	73-33	0.88	585.2	7-4-01	31-7-01	1716	1956	2.9	15-6-01	30-7-01	233.4	175.2	76.9
2-10	Tomato	73-33	0.88	585.2	8-4-01	31-7-01	1716	1956	2.9	15-6-01	30-7-01	233.4	175.2	76.9
1-1	Tomato	Beril	0.76	504	5-4-01	11-7-01	1500	1985	3.0	15-6-01	10-7-01	0.0	0.0	0.0
2-3	Tomato	Beril	0.88	585.2	7-4-01	31-7-01	1716	1956	2.9	15-6-01	30-7-01	293.2	76.9	76.9
2-4	Tomato	Beril	0.88	585.2	7-4-01	31-7-01	1848	2106	3.2	15-6-01	30-7-01	293.2	76.9	76.9
2-5	Tomato	Beril	0.88	585.2	4-4-01	10-7-01	1716	1956	2.9	15-6-01	8-7-01	25.6	25.6	25.6
2-11	Tomato	Beril	0.88	585.2	7-4-01	19-7-01	1650	1881	2.8	15-6-01	18-7-01	77.8	98.3	355.6
3-2	Pepper	Polka	0.87	577.6	8-4-01	3-9-01	1764	2037	3.1	20-6-01	2-9-01	0.0	0.0	0.0
1-8	Pepper	Sirtaki	0.76	504	20-4-01	3-9-01	1560	2065	3.1	23-6-01	30-8-01	47.6	75.4	29.8
1-9	Pepper	Sirtaki	0.76	504	20-4-01	20-9-01	1560	2065	3.1	23-6-01	20-9-01	0.0	0.0	0.0
3-1	Pepper	Sirtaki	0.87	577.6	20-4-01	21-9-01	1386	1601	2.4	23-6-01	21-9-01	0.0	0.0	0.0
3-3	Pepper	Sirtaki	0.88	585.2	21-4-01	22-9-01	1386	1580	2.4	23-6-01	15-9-01	78.6	0.0	0.0
2-2	Pepper	Salvita	0.88	585.2	8-4-01	25-8-01	1848	2106	3.2	20-6-01	24-8-01	0.0	0.0	0.0
3-4	Pepper	Salvita	0.88	585.2	8-4-01	21-9-01	1664	1897	2.8	20-6-01	2-9-01	78.6	0.0	0.0
1-4	Cucumber	Deltastar	0.76	504	6-4-01	15-8-01	1800	2382	3.6	11-5-01	10-8-01	582	94	94
1-10	Cucumber	Deltastar	0.76	504	7-4-01	25-6-01	1680	2223	3.3	11-5-01	25-6-01	0	0	0
1-12	Cucumber	Deltastar	0.76	504	6-4-01	20-8-01	1800	2382	3.6	14-5-01	15-8-01	819	134	392
1-7	Cucumber	Deltastar	0.76	504	7-4-01	25-6-01	1680	2223	3.3	6-5-01	25-6-01	185	75	30
1-5	Cucumber	Chinese	0.76	504	4-4-01	25-6-01	1800	2382	3.6	28-4-01	23-6-01	160	0	0

Greenhouse No.	Species	Variety	Yield kg/m²	Water total mm	Pesticide total kg/ha	Price Yuans	Price Yuans per pound	Soil NO3-N mg/kg	Soil N(20cm) kg/ha	Products analysis results % sugar	Products analysis results VitC mg/100g	Products analysis results Nitrate mg/kg	Products analysis results DM (%)
3-5	Eggplant	Andrea	1.72	389.5	0.047	567.0	0.3						
1-3	Eggplant	Andrea	1.91	267.9	0.018	528.0	0.3			2.85	1.85		
1-11	Eggplant	Andrea	2	461.3	4.078	664.0	0.3						
1-6	Eggplant	Longo	1.83	461.3	0.019	534.0	0.3	9.6	24.96	2.34	1.44	636.9	6.95
2-1	Eggplant	Longo	1.24	435.7	0.097	350.0	0.2	11	28.6	3.02	1.04	582.4	
2-7	Tomato	Beril	3.48		0.000	780.0	0.2						
2-7	Cherry tom.	72-68	0	352.4	6.608					3.13	18	171.1	
2-8	Tomato	Beril	4.53		0.000	870.0	0.2						
2-8	Cherry tom.	72-68	0	440.6	6.608								
1-2	Tomato	73-33	3.77	282.7	0.416	750.0	0.2			2.27	13.3	251.8	
2-12	Tomato	73-33	3.5	320.4	1.392	1654.0	0.4			2.97	18.3	200.1	
2-6	Tomato	73-33	3.45	243.5	5.470	1041.0	0.3			3.24	21.4	226	
2-9	Tomato	73-33	3.61	320.4	1.786	1302.0	0.3			3.48	20.8	155.8	
2-10	Tomato	73-33	3.77	320.4	1.380	1365.0	0.3						
1-1	Tomato	Beril	3.92	282.7	0.416	850.0	0.2			2.85	21.6	251	
2-3	Tomato	Beril	3.75	269.1	1.315	1353.0	0.3			3	16.5	134	
2-4	Tomato	Beril	3.73	320.4	1.315	1355.0	0.3						
2-5	Tomato	Beril	3.37	269.1	5.131	1038.0	0.3			2.42	39.8	234	6.02
2-11	Tomato	Beril	3.34	320.4	1.392	1548.0	0.4			3.12	17.3	190.1	
3-2	Pepper	Polka	0.18	233.7	0.017	147.0	0.7			3.4	77.6	380.2	
1-8	Pepper	Sirtaki	0.36	282.7	0.019	235.0	0.7	11.2	29.12	4.41	114	665	
1-9	Pepper	Sirtaki	0.21	208.3	0.063	136.0	0.6	9.2	23.92	3.48	29.8	533.5	
3-1	Pepper	Sirtaki	0.18	233.7	0.017	162.0	0.8	11.9	30.94	2.8	68.7	402	
3-3	Pepper	Sirtaki	0.17	192.2	0.016	128.0	0.6	12	31.2	3.69	74.6	885.9	
2-2	Pepper	Salvita	0.33	422.9	0.097	258.0	0.7						
3-4	Pepper	Salvita	0.65	358.9	0.023	498.0	0.7			2.93	77.6	541.7	6.36
1-4	Cucumber	Deltastar	3.43	654.8	7.560	4500.0	1.3			3.68	17.1	631.6	
1-10	Cucumber	Deltastar	3.82	193.5	2.650	5005.0	1.3			2.79	19.3	689.2	8.2
1-12	Cucumber	Deltastar	4.71	907.7	33.483	6716.0	1.4			3.46	19.2	698.9	
1-7	Cucumber	Deltastar	3.89	491.1	7.895	1650.0	0.4			2.78	12.1	826.4	
1-5	Cucumber	Deltastar and Chinese	4.13	669.6	4.862	1887.1	0.5			2.3	11.7	541.2	

Table 1.11. Fertilisation management (pounds/mu and kg/ha) in Dang Chen for the spring season 2001.

Greenhouse No.	Sp., Var.	Date	Type	Pounds	% N	Pounds N per mu	kg N per ha	% P_2O_5	Pounds P_2O_5 per mu	kg P_2O_5 per ha	% K_20	Pounds K_2O per mu	kg K_2O per ha
1-6	Eggplant,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.8	0.86	34.1	256.1
	Longo	1-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		11-6-01	compound fert.	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		18-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
3-4	Pepper,		chicken manure	3300	1.26	47.4	355.4	1.31	49.3	369.6	0.86	32.4	242.6
	Salvita	16-5-01	urea	20	46	10.5	78.6		0.0	0.0		0.0	0.0
3-5	Eggplant,		chicken manure	3300	1.26	48.0	360.1	1.31	49.9	374.4	0.86	32.8	245.8
	Andrea	1-6-01	urea	20	46	10.6	79.7		0.0	0.0		0.0	0.0
		11-6-01	compound fert.	30	15	5.2	39.0	15	5.2	39.0	15	5.2	39.0
		18-6-01	urea	20	46	10.6	79.7		0.0	0.0		0.0	0.0
2-5	Tomato,		chicken manure	3300	1.26	47.4	355.4	1.31	49.2	369.6	0.86	32.4	242.6
	Beril	1-6-01	compound fert.	20	15	3.4	25.6	15	3.4	25.7	15	3.4	25.7
2-6	Tomato,		chicken manure	3300	1.26	47.4	355.4	1.31	49.3	369.6	0.86	32.4	242.6
	73-33	1-6-01	compound fert.	20	15	3.4	25.6	15	3.4	25.7	15	3.4	25.7
1-5	Cucumber,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Chinese	13-5-01	urea	15	46	9.1	68.5		0.0	0.0		0.0	0.0
		1-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
1-10	Cucumber, Deltastar		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.9	34.1	256.1
2-9	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.3	44.8	336.0	0.9	29.4	220.6
	73-33	16-5-01	urea	30	46	15.7	118.0		0.0	0.0		0.0	0.0
		21-5-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.1	38.5
		27-5-01	ammonium phosphate	25	18	5.1	38.5	46	13.1	98.3		0.0	0.0
		4-6-01	compound fert.	30	15	5.1	38.5	15	5.1	38.4	15	5.1	38.5
2-10	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
	73-33	16-5-01	urea	30	46	15.7	118.0		0.0	0.0		0.0	0.0
		21-5-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.1	38.5
		27-5-01	ammonium phosphate	25	18	5.1	38.5	46	13.1	98.3		0.0	0.0
		4-6-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.1	38.5
1-9	Pepper, Sirtaki		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.14	256.1
3-1	Pepper, Sirtaki		chicken manure	3000	1.26	43.7	327.4	1.31	45.4	340.4	0.86	29.79	223.5
3-2	Pepper, Polka		chicken manure	3000	1.26	43.7	327.4	1.31	45.4	340.4	0.86	29.79	223.5
2-3	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.41	220.6
	Beril	16-5-01	urea	30	46	15.7	118.0		0.0	0.0		0.00	0.0
		25-5-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.13	38.5
		3-6-01	urea	25	46	13.1	98.3		0.0	0.0		0.00	0.0
		10-6-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.13	38.5
2-4	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
	Beril	16-5-01	urea	30	46	15.7	118.0		0.0	0.0		0.0	0.0
		25-5-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.1	38.5
		3-6-01	urea	25	46	13.1	98.3		0.0	0.00		0.0	0.0
		10-6-01	compound fert.	30	15	5.1	38.5	15	5.1	38.5	15	5.1	38.5

Greenhouse No.	Sp., Var.	Date	Type	Pounds	% N	Pounds N per mu	kg N per ha	% P_2O_5	Pounds P_2O_5 per mu	kg P_2O_5 per ha	% K_20	Pounds K_2O per mu	kg K_2O per ha
no.3	Eggplant,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Andrea	16-5-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		25-5-01	compound fert.	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		3-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
no. 4	Cucumber,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Deltastar	14-5-01	urea	12	46	7.3	54.8		0.0	0.0		0.0	0.0
			compound fert.	13	15	2.6	19.4	15	2.6	19.4	15	2.6	19.4
		19-5-01	urea	25	46	15.2	114.1		0.0	0.0		0.0	0.0
		3-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		4-6-01	compound fert.	20	15	4.0	29.8	15	4.0	29.8	15	4.0	29.8
		20-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		4-7-01	compound fert.	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		20-7-01	urea	30	46	18.3	137.0		0.0	0.0		0.0	0.0
1-12	Cucumber,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Deltastar	15-5-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		21-5-01	urea	10	46	6.1	45.7		0.0	0.0		0.0	0.0
			potassium sulphate	10		0.0	0.0		0.0	0.0	52	6.9	51.6
		26-5-01	compound fert.	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		2-6-01	urea	10	46	6.1	45.7		0.0	0.0		0.0	0.0
			potassium sulphate	10		0.0	0.0		0.0	0.0	52	6.9	51.6
		9-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		15-6-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		21-6-01	urea	10	46	6.1	45.7		0.0	0.0		0.0	0.0
			potassium sulphate	10		0.0	0.0		0.0	0.0	52	6.9	51.6
		27-6-01	compound fert.	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		3-7-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		9-7-01	urea	10	46	6.1	45.7		0.0	0.0		0.0	0.0
			potassium sulphate	10		0.0	0.0		0.0	0.0	52	6.9	51.6
		15-7-01	compound fert.	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		21-7-01	urea	20	46	12.2	91.3		0.0	0.0		0.0	0.0
		27-7-01	urea	10	46	6.1	45.7		0.0	0.0		0.0	0.0
			potassium sulphate	10		0.0	0.0		0.0	0.0	52	6.9	51.6
3-3	Pepper,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
	Sirtaki	21-5-01	urea	20	46	10.5	78.6		0.0	0.0		0.0	0.0

Greenhouse No.	Sp., Var.	Date	Type	Pounds	% N	Pounds N per mu	kg N per ha	% P_2O_5	Pounds P_2O_5 per mu	kg P_2O_5 per ha	% K_20	Pounds K_2O per mu	kg K_2O per ha
2-12	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	335.95	0.86	29.41	220.55
	73-33	16-5-01	potassium sulphate	30		0.0	0.0		0.0	0.00	52	17.78	133.35
			urea	5	46	2.6	19.7		0.0	0.00		0.00	0.00
		21-5-01	potassium sulphate	30		0.0	0.0		0.0	0.00	52	17.78	133.35
			urea	5	46	2.6	19.7		0.0	0.00		0.00	0.00
		27-5-01	ammonium phosphate	25	18	5.1	38.5	46	13.1	98.31		0.00	0.00
		4-6-01	potassium sulphate	20		0.0	0.0		0.0	0.00	52	11.85	88.90
			urea	5	46	2.6	19.7		0.0	0.00		0.00	0.00
2-11	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	335.95	0.86	29.41	220.55
	Beril	16-5-01	potassium sulphate	30		0.0	0.0		0.0	0.00	52	17.78	133.35
			urea	5	46	2.6	19.7		0.0	0.00		0.00	0.00
		21-5-01	potassium sulphate	30		0.0	0.0		0.0	0.00	52	17.78	133.35
			urea	5	46	2.6	19.7		0.0	0.00		0.00	0.00
		27-5-01	ammonium phosphate	25	18	5.1	38.5	46	13.1	98.31		0.00	0.00
		4-6-01	potassium sulphate	20		0.0	0.0		0.0	0.00	52	11.85	88.90
			urea	5		0.0	0.0		0.0	0.00		0.00	0.00
1-11	Eggplant,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Andrea	20-5-01	urea	20		0.0	0.0		0.0	0.0		0.0	0.0
		26-5-01	compound fertiliser	30		0.0	0.0	15	6.0	44.7	15	6.0	44.7
		1-6-01	potassium sulphate	30		0.0	0.0		0.0	0.0	52	20.7	154.8
		10-6-01	compound fertiliser	30	15	6.0	44.7	15	6.0	44.7	15	6.0	44.7
		3-6-01	urea	20	46	12.2	91.3		0.00	0.0		0.0	0.0
2-7	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
	Beril/	30-5-01	compound fertiliser	20	15	3.4	25.6	15	3.4	25.7	15	3.4	25.7
	72-68		ammonium phosphate	10	18	2.1	15.4	46	5.2	39.3		0.0	0.0
2-8	Tomato,		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
	Beril/	30-5-01	compound fertiliser	20	15	3.4	25.6	15	3.4	25.77	15	3.4	25.7
	72-68		ammonium phosphate	10	18	2.1	15.4	46	5.2	39.3		0.0	0.0
1-7	Cucumber,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Deltastar	30-5-01	compound fertiliser	20	15	4.0	29.8	15	4.0	29.8	15	4.0	29.8
			ammonium phosphate	10	18	2.4	17.9	46	6.1	45.7		0.0	0.0
		7-6-01	urea	30	46	18.3	137.0		0.0	0.0		0.0	0.0
1-8	Pepper,		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
	Sirtaki	30-5-01	compound fertiliser	20	15	4.0	29.8	15	4.0	29.8	15	4.0	29.8
			ammonium phosphate	10	18	2.4	17.9	46	6.1	45.7		0.0	0.0
2-1	Eggplant, Longo		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
2-2	Pepper, Salvita		chicken manure	3000	1.26	43.1	323.1	1.31	44.8	336.0	0.86	29.4	220.6
no. 1	Tomato, Beril		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1
no. 2	Tomato, 73-33		chicken manure	3000	1.26	50.0	375.2	1.31	52.0	390.1	0.86	34.1	256.1

Table 1.12. Fertiliser application on each greenhouse of Dang Chen; organic, chemical and total N,P,K-input during the spring planting season 2001.

			kg N/ha			kg P_2O_5/ha			kg K_2O/ha		
Greenhouse			Organic	Chemicals	Total	Organic	Chemicals	Total	Organic	Chemicals	Total
No.	Species	Variety	manure	total	N-input	manure	total	P_2O_5-input	manure	total	K_2O-input
3-5	Eggplant	Andrea	360	198	558	374	39	413	246	39	285
1-3	Eggplant	Andrea	375	227	602	390	45	435	256	45	301
1-11	Eggplant	Andrea	375	136	511	390	89	479	256	244	500
1-6	Eggplant	Longo	375	227	602	390	45	435	256	45	301
2-1	Eggplant	Longo	323	0	323	336	0	336	221	0	221
2-7	Tomato	Beril	323	41	364	336	65	401	221	26	246
2-7	Cherry tom.	72-68	323	41	364	336	65	401	221	26	246
2-8	Tomato	Beril	323	41	364	336	65	401	221	26	246
2-8	Cherry tom.	72-68	323	41	364	336	65	401	221	26	246
1-2	Tomato	73-33	375	0	375	390	0	390	256	0	256
2-12	Tomato	73-33	323	97	421	336	98	434	221	356	576
2-6	Tomato	73-33	355	26	381	370	26	395	243	26	268
2-9	Tomato	73-33	323	233	556	336	175	511	221	77	297
2-10	Tomato	73-33	323	233	556	336	175	511	221	77	297
1-1	Tomato	Beril	375	0	375	390	0	390	256	0	256
2-3	Tomato	Beril	323	293	616	336	77	413	221	77	297
2-4	Tomato	Beril	323	293	616	336	77	413	221	77	297
2-5	Tomato	Beril	355	26	381	370	26	395	243	26	268
2-11	Tomato	Beril	323	78	401	336	98	434	221	356	576
3-2	Pepper	Polka	327	0	327	340	0	340	223	0	223
1-8	Pepper	Sirtaki	375	48	423	390	75	466	256	30	286
1-9	Pepper	Sirtaki	375	0	375	390	0	390	256	0	256
3-1	Pepper	Sirtaki	327	0	327	340	0	340	223	0	223
3-3	Pepper	Sirtaki	323	79	402	336	0	336	221	0	221
2-2	Pepper	Salvita	323	0	323	336	0	336	221	0	221
3-4	Pepper	Salvita	355	79	434	370	0	370	243	0	243
1-4	Cucumber	Deltastar	375	582	958	390	94	484	256	94	350
1-10	Cucumber	Deltastar	375	0	375	390	0	390	256	0	256
1-12	Cucumber	Deltastar	375	819	1194	390	134	524	256	392	648
1-7	Cucumber	Deltastar	375	185	560	390	75	466	256	30	286
1-5	Cucumber	Chinese	375	160	535	390	0	390	256	0	256

Table 1.13. Crop protection management (g/mu and g/ha) in Dang Chen for the spring planting season 2001.

Greenhouse No.	Sp., Var.	Date	Type		Amount (g) (ml)	g/mu	g/ha	Specification
1-6	Eggplant,	21-5-01	齐螨素		40	52.9	794	1.80%
	Longo	10-6-01	稳得		60	79.4	1190	0.40%
3-4	Pepper,	12-7-01	齐螨素		60	68.4	1025	1.80%
	Salvita	25-7-01	稳得		60	68.4	1025	0.40%
3-5	Eggplant,	21-5-01	齐螨素		40	46.2	693	1.80%
	Andrea	10-6-01	稳得		60	69.3	1039	0.40%
2-5	Tomato,	7-4-01	乐斯本		375	427.4	6408	48%
	Beril	23-5-01	齐螨素		20	22.8	342	1.80%
		23-5-01	绿芬威3号	liquid fert.	50	57.0	854	62.00%
		25-5-01	绿芬威3号	liquid fert.	50	57.0	854	62.00%
		25-5-01	菌必治		50	57.0	854	50.00%
		1-6-01	菌必治		100	114.0	1709	50.00%
		7-6-01	百腐烟剂		100	114.0	1709	20.00%
		17-6-01	稳得		60	68.4	1025	40.00%
		25-6-01	齐螨素		40	45.6	684	1.80%
		2-7-01	农哈哈		40	45.6	684	0.50%
2-6	Tomato,	7-4-01	乐斯本		375	427.4	6408	48.00%
	73-33	23-5-01	齐螨素		20	22.8	342	1.80%
		23-5-01	绿芬威3号	liquid fert.	50	57.0	854	62.00%
		25-5-01	绿芬威3号	liquid fert.	50	57.0	854	62.00%
		25-5-01	菌必治		50	57.0	854	50.00%
		1-6-01	菌必治		100	114.0	1709	50.00%
		7-6-01	百腐烟剂		100	114.0	1709	20.00%
		17-6-01	稳得		60	68.4	1025	40.00%
		25-6-01	齐螨素		40	45.6	684	1.80%
		2-7-01	农哈哈		40	45.6	684	50.00%
5	Cucumber,	21-5-01	齐螨素		20	26.5	397	1.80%
	Chinese	21-5-01	绿芬威1、2号	liquid fert.	50	66.2	992	58.00%
		26-5-01	绿芬威1、2号	liquid fert.	75	99.3	1488	58.00%
		26-5-01	霜霉净		100	132.3	1984	76.00%
		10-6-01	代森锰锌		120	158.8	2381	70.00%
		17-6-01	代森锰锌		121	160.1	2401	70.00%
1-10	Cucumber,	7-5-01	齐螨素		20	26.5	397	1.80%
	Deltastar	7-5-01	霜克		1000	1323.4	19841	5.00%
		14-5-01	齐螨素		20	26.5	397	1.80%
		14-5-01	霜克		1000	1323.4	9841	5.00%
		20-5-01	甲霜灵		90	119.1	1786	25.00%
		20-5-01	绿菜宝2号	pesticide	45	59.6	893	23.00%
2-9	Tomato,	23-5-01	菌必治		75	85.5	1282	50.00%
	73-33	23-5-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		30-5-01	菌必治		75	85.5	1282	50.00%
		30-5-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		10-6-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		10-6-01	齐螨素		30	34.2	0513	1.80%
		17-6-01	稳德		60	68.4	1025	40.00%
		17-6-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%

Greenhouse No.	Sp., Var.	Date	Type		Amount (g) (ml)	g/mu	g/ha	Specification
		25-6-01	一遍净		40	45.63	684	10.00%
		25-6-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		7-7-01	齐螨素		40	45.6	684	1.80%
		17-7-01	稳德		60	68.4	1025	0.40%
2-10	Tomato,	23-5-01	菌必治		75	85.5	1282	50.00%
	73-33	23-5-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		30-5-01	菌必治		75	85.5	1282	50.00%
		30-5-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		10-6-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		10-6-01	齐螨素		30	34.2	513	1.80%
		17-6-01	稳德		60	68.4	1025	0.40%
		17-6-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		25-6-01	一遍净		40	45.6	684	10.00%
		25-6-01	绿芬威3号	liquid fert.	75	85.5	1282	62.00%
		7-7-01	齐螨素		40	45.6	684	1.80%
		17-7-01	稳德		60	68.4	1025	0.40%
3-1	Pepper,	5-6-01	齐螨素		40	46.2	693	1.80%
	Sirtaki	25-6-01	稳德		60	69.3	1039	0.40%
3-2	Pepper,	5-6-01	齐螨素		40	46.2	693	1.80%
	Polka	25-6-01	稳德		60	69.3	1039	0.40%
2-3	Tomato,	24-5-01	菌必治		75	85.5	1282	50.00%
	Beril	24-5-01	绿芬威3号		75	85.5	1282	62.00%
		31-5-01	菌必治		75	85.5	1282	50.00%
		31-5-01	绿芬威3号		75	85.5	1282	62.00%
		10-6-01	绿芬威3号		75	85.5	1282	62.00%
		10-6-01	齐螨素		30	34.2	513	1.80%
		18-6-01	稳德		60	68.4	1025	0.40%
		18-6-01	绿芬威3号		100	114.0	1709	62.00%
		25-6-01	农哈哈		40	45.6	684	0.50%
		25-6-01	绿芬威3号		100	114.0	1709	62.00%
		5-7-01	齐螨素		40	45.6	684	1.80%
		15-7-01	稳德		60	68.4	1025	0.40%
3	Eggplant,	23-5-01	农哈哈		40	52.9	794	0.50%
	Andrea	10-6-01	齐螨素		40	52.9	794	1.80%

Greenhouse No.	Sp., Var.	Date	Type	Amount (g) (ml)	g/mu	g/ha	Specification
2-4	Tomato,	24-5-01	菌必治	75	85.5	1282	50.00%
	Beril	24-5-01	绿芬威3号	75	85.5	1282	62.00%
		31-5-01	菌必治	75	85.5	1282	50.00%
		31-5-01	绿芬威3号	75	85.5	1282	62.00%
		10-6-01	绿芬威3号	75	85.5	1282	62.00%
		10-6-01	齐螨素	30	34.2	513	1.80%
		18-6-01	稳德	60	68.4	1025	0.40%
		18-6-01	绿芬威3号	100	114.0	1709	62.00%
		25-6-01	农哈哈	40	45.6	684	0.50%
		25-6-01	绿芬威3号	100	114.0	1709	62.00%
		5-7-01	齐螨素	40	45.6	684	1.80%
		15-7-01	稳德	60	68.4	1025	0.40%
4	Cucumber,	5-6-01	一遍净	100	132.3	1984	10.00%
	Deltastar	12-6-01	百菌清	100	132.3	1984	75.00%
		19-6-01	代森锰锌	120	158.8	2381	70.00%
		25-6-01	霜霉净	100	132.3	1984	76%
		3-7-01	杀毒矾	100	132.3	1984	64.00%
		15-7-01	霜脲锰锌	100	132.3	1984	72.00%
1	Tomato,	27-5-01	绿芬威3号	75	99.3	1488	62.00%
	Beril	29-5-01	绿芬威3 号	75	99.3	1488	62.00%
		7-6-01	百腐	100	132.3	1984	20.00%
		16-6-01	阿维虫清	40	52.9	794	1.80%
		3-7-01	稳德	60	79.4	1190	0.40%
2	Tomato,	27-5-01	绿芬威3号	75	99.3	1488	62.00%
	73-33	29-5-01	绿芬威3 号	75	99.3	1488	62.00%
		7-6-01	百腐	100	132.3	1984	20.00%
		16-6-01	阿维虫清	40	52.9	794	1.80%
		3-7-01	稳德	60	79.4	1190	0.40%
1-12	Cucumber,	17-5-01	代森锰锌	45	59.6	893	70.00%
	Deltastar		百菌清	45	59.6	893	75.00%
			绿芬威	75	99.3	1488	60.00%
			齐螨素	21	27.8	417	1.80%
		19-5-01	代森锰锌	45	59.6	893	70.00%
			百菌清	45	59.6	893	75.00%
			绿芬威	75	99.3	1488	60.00%
		23-5-01	代森锰锌	45	59.6	893	70.00%
			霜霉净	45	59.6	893	75.00%
			齐螨素	21	27.8	417	1.80%
		31-5-01	百菌清	45	59.6	893	75.00%
			霜霉净	45	59.6	893	76.00%
			绿芬威	75	99.3	1488	60.00%
			齐螨素	21	27.8	417	1.80%
		5-6-01	百菌清	45	59.6	893	75.00%
			霜霉净	45	59.6	893	76.00%
			绿芬威	75	99.3	1488	60.00%
			齐螨素	21	27.8	417	1.80%
		11-6-01	百菌清	45	59.6	893	75.00%
			霜霉净	45	59.6	893	76.00%
			绿芬威	75	99.3	1488	60.00%

Greenhouse No.	Sp., Var.	Date	Type	Amount (g) (ml)	g/mu	g/ha	Specification
			齐螨素	21	27.8	417	1.80%
		17-6-01	代森锰锌	45	59.6	893	70.00%
			百菌清	45	59.6	893	75.00%
			绿芬威	75	99.3	1488	60.00%
		23-6-01	霜霉净	100	132.3	1984	76.00%
			绿芬威	75	99.3	1488	60.00%
		30-6-01	代森锰锌	120	158.8	2381	70.00%
			绿芬威	100	132.3	1984	60.00%
		5-7-01	百菌清	120	158.8	2381	75.00%
			绿芬威	100	132.3	1984	60.00%
		11-7-01	百菌清	60	79.4	1190	75.00%
			霜霉净	60	79.4	1190	76.00%
			绿芬威	100	132.3	1984	60%
		17-7-01	代森锰锌	60	79.4	1190	70.00%
			百菌清	60	79.4	1190	75.00%
		23-7-01	霜霉净	120	158.8	2381	76.00%
		30-7-01	百菌清	120	158.8	2381	75.00%
		5-8-01	霜脲锰锌	100	132.3	1984	72.00%
			绿芬威	75	99.3	1488	60%
3-3	Pepper,	19-7-01	齐螨素	40	45.6	684	1.80%
	Sirtaki	29-7-01	稳德	60	68.4	1025	0.40%
2-12	Tomato,	23-5-01	菌必治	75	85.5	1282	50.00%
	73-33		绿芬威3号	75	85.5	1282	62.00%
		30-5-01	菌必治	75	85.5	1282	50.00%
			绿芬威3号	75	85.5	1282	62.00%
		10-6-01	齐螨素	30	34.2	513	1.80%
			绿芬威3号	75	85.5	1282	62.00%
		17-6-01	稳德	60	68.4	1025	0.40%
			绿芬威3号	75	85.5	1282	62.00%
		25-6-01	一遍净	40	45.6	684	10.00%
			绿芬威3号	75	85.5	1282	62.00%
		30-6-01	齐螨素	40	45.6	684	1.80%
			绿芬威3号	75	85.5	1282	62.00%
		7-7-01	虫螨克星	40	45.6	684	1.80%
		15-7-01	稳德	60	68.4	1025	0.40%

Greenhouse No.	Sp., Var.	Date	Type	Amount (g) (ml)	g/mu	g/ha	Specification
2-11	Tomato,	23-5-01	菌必治	75	85.5	1282	50.00%
	Beril		绿芬威3号	75	85.5	1282	62.00%
		30-5-01	菌必治	75	85.5	1282	50.00%
			绿芬威3号	75	85.5	1282	62.00%
		10-6-01	齐螨素	30	34.2	513	1.80%
			绿芬威3号	75	85.5	1282	62.00%
		17-6-01	稳德	60	68.4	1025	0.40%
			绿芬威3号	75	85.5	1282	62.00%
		25-6-01	一遍净	40	45.6	684	10.00%
			绿芬威3号	75	85.5	1282	62.00%
		30-6-01	齐螨素	40	45.6	684	1.80%
			绿芬威3号	75	85.5	1282	62.00%
		7-7-01	虫螨克星	40	45.6	684	1.80%
		15-7-01	稳德	60	68.4	1025	0.40%
1-11	Eggplant,	24-5-01	代森锰锌	120	158.8	2381	70.00%
	Andrea		绿芬威	75	99.3	1488	60.00%
		10-6-01	霜霉净	100	132.3	1984	76.00%
			齐螨素	30	39.7	595	1.80%
2-7	Tomato, Beril	24-5-01	菌必治	75	85.6	1282	50.00%
2-7	Tomato, 72-68		好帮手	200	228.0	3418	55.00%
			绿芬威	75	85.5	1282	60.00%
		3-6-01	菌必治	75	85.5	1282	50.00%
			好帮手	200	228.0	3418	55.00%
			绿芬威	75	85.5	1282	60.00%
		10-6-01	齐螨素	40	45.6	684	1.80%
		20-6-01	阿维虫清	40	45.6	684	1.80%
		30-6-01	稳德	60	68.4	1025	0.40%
2-8	Tomato, Beril	24-5-01	菌必治	75	85.5	1282	50.00%
2-8	Tomato, 72-68		好帮手	200	228.0	3418	55.00%
			绿芬威	75	85.5	1282	60.00%
		3-6-01	菌必治	75	85.5	1282	50.00%
			好帮手	200	228.0	3418	55.00%
			绿芬威	75	85.5	1282	60.00%
		10-6-01	齐螨素	40	45.6	684	1.80%
		20-6-01	阿维虫清	40	45.6	684	1.80%
		30-6-01	稳德	60	68.4	1025	0.40%
1-7	Cucumber,	20-5-01	百菌清	90	119.1	1786	75.00%
	Deltastar	26-5-01	霜霉净	100	132.3	1984	76.00%
		2-6-01	霜脲锰锌	120	158.8	2381	72.00%
		9-6-01	代森锰锌	120	158.8	2381	70.00%
		16-6-01	代森锰锌	120	158.8	2381	70.00%
1-8	Pepper,	3-6-01	齐螨素	40	52.9	794	1.80%
	Sirtaki	26-6-01	稳德	60	79.4	1190	0.40%

Greenhouse No.	Sp., Var.	Date	Type	Amount (g) (ml)	g/mu	g/ha	Specification
2-1	Eggplant,	30-5-01	一遍净	40	45.6	684	10.00%
	Longo		齐螨素	40	45.6	684	1.80%
			稳德	60	68.4	1025	0.40%
		15-6-01	阿维虫清	40	45.6	684	1.80%
2-2	Pepper,	30-5-01	一遍净	40	45.6	684	10.00%
	Salvita		齐螨素	40	45.6	684	1.80%
			稳德	60	68.4	1025	0.40%
		15-6-01	阿维虫清	40	45.6	684	1.80%
1-9	Pepper,	6-6-01	农哈哈	30	39.7	595	0.50%
	Sirtaki	25-6-01	一遍净	30	39.7	595	10.00%

Table 1.14. Irrigation management (mm) in Dang Cheng for the spring planting season 2001 (15 m³ per hour).

Greenhouse no.	1-6 E	3-4 P	3-5 E	2-5 T	2-6 T	5 C	1-10 C	2-9 T	2-10 T	1-9 P	3-1 P	3-2 P	2-3 T	2-4 T	3 E	4 C	1-12 C	3-3 P	2-12 T	2-11 T	1-11 E	1-13 E	1-14 E	2-13 P	2-14 P	2-15 E	2-7 T	2-8 T	1-7 C	1-8 P	2-1 E	2-2 P	1 T	2 T
4-apr				51	51	60																												
5-apr																																	60	60
6-apr																60	60																	
7-apr				38	38		60	51	51				51	51						52							51	51	60					
8-apr		51	52									52			60				52		60												
11-apr																																	45	45
15-apr			39																															
16-apr																45																		
17-apr																											38	38	45					
18-apr								38	38			39	38	38			45		38	38	45													
19-apr	60																																	
20-apr										60	52																			60	51	51		
21-apr																		51																
23-apr		38																																
25-apr																													45					
27-apr	45																																	
28-apr				38	38																	60		51	51	51								
29-apr																							59											
1-may						45	45			45	39				45	45																		
5-may																															38	38		
7-may						45	45																											
8-may								38	38				38	38			45		38	38	60													
10-may																														45				
11-may																													45					
12-may																																		
13-may						45												38				45	45	38	38	38								
14-may																45																		

Greenhouse no.	1-6 E	3-4 P	3-5 E	2-5 T	2-6 T	5 C	1-10 C	2-9 T	2-10 T	1-9 P	3-1 P	3-2 P	2-3 T	2-4 T	3 E	4 C	1-12 C	3-3 P	2-12 T	2-11 T	1-11 E	1-13 E	1-14 E	2-13 P	2-14 P	2-15 E	2-7 T	2-8 T	1-7 C	1-8 P	2-1 E	2-2 P	1 T	2 T
15-may							45			45							45																	
16-may		38	39	38	38			38	38		39	39	38	38					38	38							38	38			38	38		
19-may															45	45																		
20-may						60															60	45	45	38	38	38								
21-may								51	51	60							60	51	51	51														
22-may																																	60	60
23-may	60			51	38																													
24-may						60																									51	38		
25-may														51																				
26-may																	60				60													
27-may								51	51										51	51														
30-may																											38	38	60	60				
1-jun	60	77	52	51	38	60															60										51	51		
2-jun																	60																	
3-jun													51	51	60	30																		
4-jun							51		51							30			51	51														
5-jun						60																					51	51						
6-jun											52	52																						
7-jun																													60					
9-jun																	60				60													
10-jun						60							51	51		60															51	51		
11-jun	60		52																															
12-jun																											51	51	60					
14-jun						60																								60				
15-jun															60		60				60													
17-jun																															51	51		
18-jun	60		52			60																							60					
20-jun		77									52	52				60		51									51	51						
21-jun																	60																	

Greenhouse no.	1-6 E	3-4 P	3-5 E	2-5 T	2-6 T	5 C	1-10 C	2-9 T	2-10 T	1-9 P	3-1 P	3-2 P	2-3 T	2-4 T	3 E	4 C	1-12 C	3-3 P	2-12 T	2-11 T	1-11 E	1-13 E	1-14 E	2-13 P	2-14 P	2-15 E	2-7 T	2-8 T	1-7 C	1-8 P	2-1 E	2-2 P	1 T	2 T
22-jun						60																											
24-jun																															51	51		
25-jun	60		52																										60	60				
27-jun																60	60															60	60
2-jul	60	77	52																														
3-jul																	60																
4-jul																60																60	60
12-jul																60																	
13-jul																															51	51		
19-jul																60																	
20-jul																60																	

(E = eggplant, P = pepper, T = tomato, C = cucumber)

Table 1.15. N,P,K nutrient balance related to the spring planting season 2001. Estimation for the chicken manure dry matter in TADC (considering 50%DM) and for the crop residues dry matter on the three sites (considering 20%DM).

			Measured inputs (kg/ha)			Measured outputs (kg/ha)					Balance	
Nitrogen			**Applied N**		**Total**	**Produce**		**Crop residue (2)**		**Total**	**Surplus**	**Yield**
			organic(1)	inorganic	**input**	min.	max.	min.	max.	**output**	(kg/ha)	kg/m²
TADC	A6	Cucumber	709	476	1185		62.3			62.3	1123	4.94
TADC	A5	Tomato	473	260	733	61	70	17.2	34.8	104.8	628	5.01
TADC	A4	Eggplant	473	396	869	21	36	41.3	67.7	103.7	765	1.84
TADC	A3	Pepper	473	242	715	30	36		19.2	55.2	660	2.38
LiuFu	S11	Cucumber		742	742	37	54		7.7	61.7	680	2.78
LiuFu	S3	Tomato		0	0	70	77		79.9	156.9		6.31
LiuFu	Out 6	Eggplant		845	845	9.6	10		28.8	38.8	806	0.54
LiuFu	Out 11	Pepper		811	811	0.7	1.1		49.9	51.0	760	0.08
D C	Line1-10	Cucumber	375	0	375	60	86		24.9	110.9	264	3.82
D C	Line2-5	Tomato	355	26	381	41	43		35.7	78.7	302	3.37
D C	Line1-6	Eggplant	375	227	602		25		28.8	53.8	548	1.83
D C	Line3-4	Pepper	355	79	434	9	13		41.4	54.4	380	0.65
Phosphorous			**Applied P**		**Total**	**P uptake**		**Crop residue**		**Total**	**Surplus**	**Yield**
			organic	inorganic	input	min.	max.	min.	max.	output		kg/m²
TADC	A6	Cucumber	322	121	442		20.7			21	421	4.94
TADC	A5	Tomato	214	102	316	13	17.5	2	6	24	292	5.01
TADC	A4	Eggplant	214	119	333	4.3	8.9	4	8	17	316	1.84
TADC	A3	Pepper	214	78	292	7.3	7.9		2	10	282	2.38
LiuFu	S11	Cucumber		0	0	11.2	13.2		1	14		2.78
LiuFu	S3	Tomato		0	0	11.2	17.6		11	29		6.31
LiuFu	Out 6	Eggplant		297	297		1.5		2	3	293	0.54
LiuFu	Out 11	Pepper		384	384	0.1	0.2		5	5	379	0.08
D C	Line1-10	Cucumber	170	0	170	11.8	14.4		3	17	153	3.82
D C	Line2-5	Tomato	162	11	173	8.1	9.7		6	16	157	3.37
D C	Line1-6	Eggplant	170	20	190		3.2		2	6	184	1.83
D C	Line3-4	Pepper	162	0	162	1.6	2.6		3	6	156	0.65
Potassium			**Applied K**		**Total**	**K uptake**		**Crop residue**		**Total**	**Surplus**	**Yield**
			organic	inorganic	input	min.	max.	min.	max.	output		kg/m²
TADC	A6	Cucumber	412	239	651		109.3			109	542	4.94
TADC	A5	Tomato	268	77	345	69	169	32	51	220	125	5.01
TADC	A4	Eggplant	268	181	449	30	57	24	82	139	310	1.84
TADC	A3	Pepper	268	34	302	45	60		14	74	228	2.38
LiuFu	S11	Cucumber		0	0	44			13	62		2.78
LiuFu	S3	Tomato		0	0	127	253		157	410		6.31
LiuFu	Out 6	Eggplant		563	563	13	15		52	67	496	0.54
LiuFu	Out 11	Pepper		540	540	1	1.6		77	78	462	0.08
D C	Line1-10	Cucumber	212	0	212	72	139		5	144	68	3.82
D C	Line2-5	Tomato	202	22	224	55	104		75	179	44	3.37
D C	Line1-6	Eggplant	212	37	249		43		75	118	131	1.83
D C	Line3-4	Pepper	202	0	202	17	19		72	91	252	0.65

Appendix II.
Data on autumn planting season 2001

Table 2.1. General data and average inputs and outputs of each greenhouse at TADC for the autumn planting season 2001.

Greenhouse			Area		First	Last	First	Yield	
No.	Species	Variety	(mu)	(m^2)	harvest date	harvest date	class (%)	kg/mu	kg/m^2
B2	Cucumber	22-72	0.34	227	24-sep-01	19-feb-02	0.5	1687	2.5
B2		Chinese traditional	0.22	147	19-dec-01	28-jan-02	0.0	227	0.3
A3		22-72	0.8	534	30-oct-01	9-feb-02	61.5	946	1.4
A2		Chinese Mini	0.8	534	22-dec-01	22-feb-02	56.6	1543	2.3
A6	Tomato	Beril	0.28	190	7-jan-02	17-jun-02	63	4887	7.3
A6		Melvin	0.16	106	7-jan-02	17-jun-02	37	3656	5.5
A6		Jinan	0.29	196	19-jan-02	17-jun-02	45	2005	3.0
A6		72-68	0.06	42	23-dec-01	1-jun-02	100	1398	2.1
A7		Beril	0.24	160	7-jan-02	17-jun-02	55	7200	10.8
A7		Melvin	0.16	107	14-jan-02	17-jun-02	77	2963	4.4
A7		Jinan	0.28	190	7-jan-02	17-jun-02	71	1909	2.9
A7		72-68	0.06	42	24-dec-01	13-jun-02	75	1832	2.7
A1	Pepper	Niva	0.10	69.17	22-feb-02	4-jul-02	81	4773	7.2
A1		Nassau	0.27	177.87	25-feb-02	8-jul-02	69	4564	6.8
A1		Salvita	0.16	108.69	25-feb-02	27-jun-02	79	3516	5.3
A1		Leila	0.15	98.8	25-feb-02	9-jul-02	58	5570	8.4
A1		Sirtaki	0.06	39.5	11-mrc-02	8-jul-02	68	3107	4.7
A1		Chinese traditional	0.06	39.5	25-feb-02	5-jul-02	76	5201	7.8
A5		Leila	0.15	98.8	26-mrc-02	14-jul-02	68	4263	6.4
A5		Niva	0.10	69.17	26-mrc-02	19-jun-02	84	3587	5.4
A5		Salvita	0.16	108.69	11-apr-02	10-jul-02	100	3590	5.4
A5		Nassau	0.27	177.87	11-apr-02	12-jul-02	83	3769	5.7
A5		Sirtaki	0.06	39.5	26-apr-02	3-jul-02	100	2786	4.2
A5		Chinese traditional	0.06	39.5	19-apr-02	14-jul-02	79	5049	7.6
A4	Eggplant	Andrea	0.23	152.95	8-mrc-02	16-jul-02	90	3262	4.9
A4		Chinese Green	0.04	23.5	9-mrc-02	17-jun-02	100	2895	4.3
A4		Chinese traditional	0.04	23.5	17-mrc-02	30-apr-02	100	2384	3.6

Greenhouse			kg N		kg P_2O_5		kg K_2O		Pesticides	
No.	Species	Variety	per mu	per ha	per mu	per ha	per mu	per ha	g/mu	g/ha
B2	Cucumber	22-72/ Chinese traditional	31.4	470	14.7	219	11.0	165	23.9	360
A3		22-72	18.8	283	18.0	270	6.9	103	11.9	177
A2		Chinese mini	18.8	283	18.0	270	6.9	103	11.9	177
A6	Tomato	Beril/ Melvin/ Jinan/ 72-68	33.0	495	21.4	319	16.9	252	72.0	1083
A7		Beril/ Melvin/ Jinan/ 72-68/	36.2	500	25.9	239	18.1	371	92.1	1378
A1	Pepper	Niva/ Nassau/ Salvita/ Leila/ Sirtaki/ Chinese traditional	76.2	1035	38.1	572	23.3	352	32.7	485
A5		Leila/ Niva/ Salvita/ Nassau/ Sirtaki/ Chinese traditional	61.6	922	31.0	464	24.4	366	32.6	487
A4	Eggplant	Andrea/ Chinese green/ Chinese traditional	131.3	1988	92.0	1405	62.1	954	40.2	601

Table 2.2. Crop protection management (g/mu and g/ha) in TADC for the autumn planting season 2001.

Greenhouse				Pesticide					
No.	Species	Variety	Date	Type	Amount		Specification	g/mu	g/ha
A3	Cucumber	22-72	15-10	cypermethrin	10	ml	16%	2.0	30.0
			21-10	cypermethrin	15	ml	16%	3.0	45.0
			27-10	cypermethrin	20	ml	16%	4.0	60.0
			30-10	pulike	40	ml	2.50%	1.3	18.8
			12-11	score	50	g	10%	4.8	72.0
			TOTAL					11.9	177.2
B2	Cucumber	22-72/	27-9	cypermethrin	10	ml	16%	2.9	42.9
		Chinese	3-10	cypermethrin	15	ml	16%	4.3	64.3
		traditional	10-10	cypermethrin	20	ml	16%	5.7	85.7
			15-10	score	50	g	10%	8.8	132.0
			21-10	score	50	g	10%	8.8	132.0
			5-11	temayyasi	50	ml	2.50%	2.2	33.5
			12-11	temayyasi	50	ml	2.50%	2.2	33.5
			19-11	temayyasi	50	ml	2.50%	2.2	33.5
			TOTAL					23.9	360.4
A2	Cucumber	Chinese	15-10	cypermethrin	10	ml	16%	2.0	30.0
		Mini	21-10	cypermethrin	15	ml	16%	3.0	45.0
			27-10	cypermethrin	20	ml	16%	4.0	60.0
			30-10	pulike	40	ml	2.50%	1.3	18.8
			12-11	score	50	g	10%	8.8	132.0
			TOTAL					11.9	177.2
A6	Tomato	Beril/	15-10	cypermethrin	18	ml	16%	3.6	54.7
		Melvin/		imidacloprid	21.5	ml	2.5%	0.7	10.2
		Jinan/	21-10	cypermethrin	18	ml	16%	3.6	54.7
		72-68		imidacloprid	21.5	ml	2.5%	0.7	10.2
			30-10	cypermethrin	18	ml	16%	3.6	54.7
				imidacloprid	21.5	ml	2.5%	0.7	10.2
			23-11	imidacloprid	27	ml	2.5%	0.9	12.8
			8-1	jinbizi	90	g	15%	17.0	256.3
			20-4	phoximfenpropa	150	g	2.5%	4.7	71.2
				imidacloprid	21.5	ml	2.5%	0.7	10.2
				actara	10.7	g	25%	3.4	50.8
			12-5	applaud	45	g	25%	14.2	213.6
			26-5	actara	21.5	g	25%	6.8	102.1
				imidacloprid	35	ml	2.5%	1.1	16.6
			1-6	actara	27	g	25%	9.2	137.7
				imidacloprid	35	ml	2.5%	1.1	16.6
			TOTAL					72.0	1082.6

Greenhouse				Pesticide					
No.	Species	Variety	Date	Type	Amount		Specification	g/mu	g/ha
A7	Tomato	Beril/	16-10	cypermethrin	19	ml	16%	4.1	61.6
		Melvin/		imidacloprid	22.5	ml	2.5%	0.8	11.4
		Jinan/	23-10	cypermethrin	19	ml	16%	4.1	61.6
		72-68		imidacloprid	22.5	ml	2.5%	0.8	11.4
			3-11	cypermethrin	19	ml	16%	4.1	61.6
				imidacloprid	22.5	ml	2.5%	0.8	11.4
			23-11	imidacloprid	28	ml	2.5%	0.9	14.2
			8-1	jinbizi	90	g	15%	18.2	273.6
			20-4	phoximfenpropathrin	150	g	2.5%	5.1	76.0
				yashike	22.5	ml	2.5%	0.8	11.4
				actara	11	g	25%	3.7	55.7
			12-5	applaud	47	g	25%	15.9	238.2
				methomyl(lannate)	65	ml	25%	22.0	329.4
			26-5	actara	28	g	25%	9.5	141.9
				imidacloprid	37	ml	2.5%	1.3	18.8
			TOTAL					92.1	1378.2

Greenhouse				Pesticide					
No.	Species	Variety	Date	Type	Amount		Specification	g/mu	g/ha
A1	Pepper	Niva/	30-10	cypermethrin	20	ml	16	4.0	60.0
		Nassau/		imidacloprid	25	ml	2.5	0.8	11.7
		Salvita/	8-11	cypermethrin	20	ml	16	4.0	60.0
		Leila/		imidacloprid	25	ml	2.5	0.8	11.7
		Sirtaki/	18-11	cypermethrin	25	ml	16	5.0	75.0
		Chinese		imidacloprid	30	ml	2.5	0.9	14.1
		traditional	1-12	imidacloprid	30	ml	2.5	0.9	14.1
			10-12	imidacloprid	30	ml	2.5	0.9	14.1
			8-3	chongmanling	36	ml	0.5	0.2	3.4
			15-3	chongmanling	18	ml	0.5	0.1	1.7
			30-3	chongmanling	18	ml	0.5	0.1	1.7
			1-4	bichonglin	4	g	10	0.5	7.5
			57-5	chongmanling	50	ml	0.5	0.3	4.7
				bichonglin	10	g	10	1.3	18.8
				actara	30	g	25	9.4	140.6
			6-6	bichonglin	10	g	10	1.3	18.8
				chongmanling	45	ml	0.5	0.3	4.2
			18-6	bichonglin	10	g	10	1.3	18.8
				chongmanling	45	ml	0.5	0.3	4.2
			TOTAL					32.7	485.1

Greenhouse				Pesticide					
No.	Species	Variety	Date	Type	Amount		Specification	g/mu	g/ha
A5	Pepper	Leila/	28-10	cypermethrin	20	ml	16	4.0	60.0
		Niva/		imidacloprid	25	ml	2.5	0.8	11.7
		Salvita/	7-11	cypermethrin	20	ml	16	4.0	60.0
		Nassau/		imidacloprid	25	ml	2.5	0.8	11.7
		Sirtaki/	15-11	cypermethrin	25	ml	16	5.0	75.0
		Chinese		imidacloprid	30	ml	2.5	0.9	14.1
		traditional	28-11	imidacloprid	30	ml	2.5	0.9	14.1
			8-12	imidacloprid	30	ml	2.5	0.9	14.1
			5-3	imidacloprid	8	ml	2.5	0.3	3.8
			4-4	chongmanling	36	ml	0.5	0.2	3.4
			30-4	chongmanling	18	ml	0.5	0.1	1.7
				bichonglin	4	g	10	0.5	7.5
			26-5	chongmanling	50	ml	0.5	0.3	4.7
				bichonglin	10	g	10	1.3	18.8
				actara	30	g	25	9.4	140.6
			3-6	chongmanling	45	ml	0.5	0.3	4.2
				bichonglin	10	g	10	1.3	18.8
			17-6	chongmanling	45	ml	0.5	0.3	4.2
				bichonglin	10	g	10	1.3	18.8
			TOTAL					32.6	487.2
A4	Eggplant	Andrea/	23-11	imidacloprid	12	ml	2.5	1.0	14.5
		Chinese	30-11	imidacloprid	12	ml	2.5	1.0	14.5
		Green/	8-12	imidacloprid	12	ml	2.5	1.0	14.5
		Chinese	13-12	imidacloprid	14	ml	2.5	1.1	16.9
		traditional	19-12	polyxinB	4	g	10	1.3	19.4
			21-12	imidacloprid	14	ml	2.5	1.1	16.9
			8-1	imidacloprid	15	ml	2.5	1.2	18.1
			15-1	imidacloprid	17	ml	2.5	1.4	20.6
			23-1	imidacloprid	17	ml	2.5	1.4	20.6
			4-4	imidacloprid	24	ml	2.5	1.9	29.0
				score(difenocohazdle)	25	g	10	8.1	121.0
			16-4	imidacloprid	24	ml	2.5	1.9	29.0
				actara(thiamethoxam)	8	g	25	6.5	96.8
			22-5	imidacloprid	20	ml	2.5	1.6	24.2
				actara(thiamethoxam)	12	g	25	9.7	145.2
			TOTAL					40.2	601.2

Table 2.3. Fertilisation management (%, kg/mu and kg/ha) in TADC for the autumn planting season 2001.

Greenhouse No.	Species	Variety	Date	Type	kg	N (%)	kg N per mu	kg N per ha	P_2O_5 (%)	kg P per mu	kg P per ha	K_2O (%)	kg K per mu	kg K per ha
A3	Cucumber	22-72	23-10	compound	7	15	1.31	19.7	15	1.31	19.7	15	1.31	19.7
				$(NH_4)_2HPO_4$	6	18	1.35	20.3	46	3.45	51.8		0.00	0.0
			9-11	KH_2PO_4	0.16		0.00	0.0	52	0.10	1.6	34	0.07	1.0
			12-11	compound	20	15	3.75	56.3	15	3.75	56.3	15	3.75	56.3
				urea	5	46.3	2.89	43.4		0.00	0.0		0.00	0.0
			26-11	urea	8.3	46.3	4.80	72.1		0.00	0.0		0.00	0.0
				$(NH_4)_2HPO_4$	13.3	18	2.99	44.9	46	7.65	114.7		0.00	0.0
				compound	9.3	15	1.74	26.2	15	1.74	26.2	15	1.74	26.2
B2	Cucumber	22-72/	15-9	$(NH_4)_2HPO_4$	10	18	3.21	48.2	46	8.21	123.2		0.00	0.0
		Chinese		urea	15	46.3	12.4	186.0		0.00	0.0		0.00	0.0
		traditional	17-9	KH_2PO_4	2.5		0.00	0.0	52	2.32	34.8	34	1.50	22.50
			17-10	compound	8.5	15	2.28	34.2	15	2.28	34.2	15	2.28	34.2
				KCL	2.5		0.00	0.0		0.00	0.0	60	2.68	40.2
			13-11	compound	7	15	1.88	28.1	15	1.88	28.1	15	1.88	28.1
				KCL	2.5		0.00	0.0		0.00	0.0	60	2.68	40.2
			10-2	urea	14	46.3	11.58	173.6		0.00	0.0		0.00	0.0
A2	Cucumber	Chinese	23-10	compound	7	15	1.31	19.7	15	1.31	19.7	15	1.31	19.7
		Mini		$(NH_4)_2HPO_4$	6	18	1.35	20.3	46	3.45	51.8		0.00	0.0
			9-11	KH_2PO_4	0.16		0.00	0.0	52	0.10	1.6	34	0.07	1.0
			12-11	compound	20	15	3.75	56.3	15	3.75	56.3	15	3.75	56.3
				urea	5	46.3	2.89	43.4		0.00	0.0		0.00	0.0
			26-11	urea	8.3	46.3	4.80	72.1		0.00	0.0		0.00	0.0
				$(NH_4)_2HPO_4$	13.3	18	2.99	44.9	46	7.65	114.7		0.00	0.0
				compound	9.3	15	1.74	26.2	15	1.74	26.2	15	1.74	26.2
A6	Tomato	Beril/	8-9	compound	10	8	1.01	15.2	8	1.01	15.2	9	1.14	17.1
		Melvin/		KH_2PO_4	0.25		0.00	0.0	52.2	0.17	2.5	34.5	0.11	1.6
		Jinan/	23-10	urea	5	46.3	2.93	43.9		0.00	0.0		0.00	0.0
		72-68		$(NH_4)_2HPO_4$	7.5	18	1.71	25.6	46	4.37	65.5		0.00	0.0
			25-12	compound	15	8	1.52	22.8	8	1.52	22.8	9	1.71	25.6
			28-1	urea	15	46.3	8.79	131.9		0.00	0.0		0.00	0.0
				KCl	10		0.00	0.0		0.00	0.0	60	7.59	113.9
				$(NH_4)_2HPO_4$	14	18	3.19	47.8	46	8.15	122.3		0.00	0.0
			17-4	urea	12.75	46.3	7.47	112.1		0.00	0.0		0.00	0.0
				compound	16	8	1.62	24.3	8	1.62	24.3	9	1.82	27.3
			14-5	compound	20	18	4.56	68.4	18	4.56	68.4	18	4.56	68.4

Greenhouse No.	Species	Variety	Date	Type	kg	N (%)	kg N per mu	kg N per ha	P_2O_5 (%)	kg P per mu	kg P per ha	K_2O (%)	kg K per mu	kg K per ha
A7	Tomato	Beril/	8-9	compound	10	8	1.08	16.2	8	1.08	16.2	9	1.22	18.2
		Melvin/	15-9	KH_2PO_4	0.25		0.00	0.0	52.2	0.18	2.6	34.5	0.12	1.7
		Jinan/	23-10	urea	5	46.3	3.12	46.9		0.00	0.0		0.00	0.0
		72-68		$(NH_4)_2HPO_4$	7.5	18	1.82	27.4	46	4.66	69.9		0.00	0.0
			30-10	$(NH_4)_2HPO_4$	5	18	1.22	18.2	46	3.11	46.6		0.00	0.0
			25-12	compound	15	8	1.62	24.3	8	1.62	24.3	9	1.82	27.4
			28-1	urea	15	46.3	9.39	140.8		0.00	0.0		0.00	0.0
				KCl	10		0.00	0.0		0.00	0.0	60	8.11	121.6
				$(NH_4)_2HPO_4$	14	18	3.41	51.1	46	8.70	130.5		0.00	0.0
			17-4	urea	12.75	46.3	7.98	119.7		0.00	0.0		0.00	0.00
				compound	16	8	1.73	25.9	8	1.73	25.9	9	1.95	29.2
			14-5	compound	20	18	4.86	73.0	18	4.86	73.0	18	4.86	73.0

Greenhouse No.	Species	Variety	Date	Type	kg	N (%)	kg N per mu	kg N per ha	P_2O_5 (%)	kg P per mu	kg P per ha	K_2O (%)	kg K per mu	kg K per ha
A1	Pepper	Niva/	23-10	comp. (sateli)	7	15	1.31	19.7	15	1.31	19.7	15	1.31	19.7
		Nassau/		$(NH_4)_2HPO_4$	7	18	1.58	23.6	46	4.00	60.4		0.00	0.0
		Salvita/	9-11	KH_2PO_4	0.15		0.00	0.0	52	0.10	1.5	34	0.06	1.0
		Leila/	16-11	urea	14	46.3	8.10	121.5		0.00	0.0		0.00	0.0
		Sirtaki/		$(NH_4)_2HPO_4$	12	18	2.70	40.5	46	6.90	103.5		0.00	0.0
		Chinese	26-11	urea	7.5	46.3	4.34	65.1		0.00	0.0		0.00	0.0
		traditional		$(NH_4)_2HPO_4$	16	18	3.6	54.0	46	9.20	138.0		0.00	0.0
			10-12	comp. (sateli)	9.5	15	1.78	26.7	15	1.78	26.7	15	1.78	26.7
			25-12	comp. (hongsanjiao)	10	8	1.00	15.0	8	1.00	15.0	9.00	1.13	16.9
				urea	2.5	46.3	1.45	21.7		0.00	0.0		0.00	0.0
			8-1	comp. (hongsanjiao)	25	8	2.5	37.5	8	2.5	37.5	9	2.75	41.3
				KCL	5		0.00	0.0		0.00	0.0	60	3.75	56.3
			22-2	comp. (hongsanjiao)	15	8	1.50	22.5	8	1.50	22.5	9	1.69	25.3
				urea	10	46.3	5.79	86.8		0.00	0.0		0.00	0.0
			13-3	comp. (hongsanjiao)	15	8	1.50	22.5	8	1.50	22.5	9	1.69	25.3
			23-3	comp. (hongsanjiao)	16	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
				urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
			1-4	comp. (hongsanjiao)	15	8	1.5	22.5	8	1.5	22.5	9	1.69	25.3
				urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
			18-4	urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
				comp. (hongsanjiao)	15	8	1.5	22.5	8	1.5	22.5	9	1.69	25.3
			1-5	urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
				comp. (hongsanjiao)	15	8	1.5	22.5	8	1.5	22.5	9	1.69	25.3
			7-6	comp. (jintudi)	10	18	2.25	33.75	18	2.25	33.75	18	2.25	33.75
				urea	5	46.3	2.89	43.41		0.00	0.0		0.00	0.0

Greenhouse No.	Species	Variety	Date	Type	kg	N (%)	kg N per mu	kg N per ha	P_2O_5 (%)	kg P per mu	kg P per ha	K_2O (%)	kg K per mu	kg K per ha
A5	Pepper	Leila/	10-10	$(NH_4)_2HPO_4$	10	18	2.25	33.8	46	5.75	86.3		0.00	0.0
		Niva/		comp. (sateli)	10	15	1.88	28.1	15	1.88	28.1	15	1.88	28.1
		Salvita/	30-10	urea	5	46.3	2.89	43.4		0.00	0.0		0.00	0.0
		Nassau/		$(NH_4)_2HPO_4$	10	18	2.25	33.8	46	5.75	86.3		0.00	0.0
		Sirtaki/		comp. (sateli)	5	15	0.94	14.1	15	0.94	14.1	15	0.94	14.1
		Chinese	18-11	comp. (sateli)	12.5	15	2.34	35.2	15	2.34	35.2	15	2.34	35.2
		Traditional		urea	14	46.3	8.10	121.5		0.00	0.0		0.00	0.0
			30-12	comp. (hongsanjiao)	25	8	2.50	37.5	8	2.50	37.5	9	2.81	42.2
			15-1	comp. (hongsanjiao)	25	8	2.50	37.5	8	2.50	37.5	9	2.81	42.2
				KCL	5		0.00	0.0		0.00	0.0	60	3.75	56.3
			8-4	urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
				comp. (hongsanjiao)	16	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			18-4	urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
				comp. (hongsanjiao)	16	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			1-5	urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
				comp. (hongsanjiao)	16	8	1.60	24.0	8	1.60	24.00	9	1.80	27.0
			6-6	urea	5	46.3	2.89	43.4		0.00	0.0		0.00	0.0
				comp. (jintudi)	10	18	2.25	33.8	18	2.25	33.8	18	2.25	33.8
			20-6	urea	5	46.3	2.89	43.4		0.00	0.0		0.00	0.0
				comp. (jintudi)	10	18	2.25	33.8	18	2.25	33.8	18	2.25	33.8

Greenhouse No.	Species	Variety	Date	Type	kg	N (%)	kg N per mu	kg N per ha	P_2O_5 (%)	kg P per mu	kg P per ha	K_2O (%)	kg K per mu	kg K per ha
A4	Eggplant	Andrea/	28-9	$(NH_4)_2HPO_4$	10	18	5.81	87.1	46	14.84	222.6		0.00	0.0
		Chinese	16-10	$(NH_4)_2HPO_4$	6	18	3.48	52.2	46	8.90	133.5		0.00	0.0
		Green/		urea	13	46.3	19.42	291.2		0.00	0.0		0.00	0.0
		Chinese	19-10	$(NH_4)_2HPO_4$	6.5	18	3.77	56.6	46	9.65	144.7		0.00	0.0
		traditional	30-10	urea	5	46.3	7.47	112.0		0.00	0.0		0.00	0.0
				$(NH_4)_2HPO_4$	3.5	18	2.03	30.5	46.00	5.19	77.9		0.00	0.0
			29-11	comp. (sateli)	15	15	7.26	108.9	15	7.26	108.9	15	7.26	108.9
			21-12	urea	4	46.3	5.97	89.6		0.00	0.0		0.00	0.0
				comp. (honhsanjiao)	7	8	1.81	27.1	8	1.81	27.1	9	2.03	30.5
			22-1	comp. (honhsanjiao)	5	8	1.29	19.4	8	1.29	19.4	9	1.45	21.8
				KCL	5		0.00	0.0		0.00	0.0	60	9.68	145.2
			11-3	KCL	5		0.00	0.0		0.00	0.0	60	9.68	145.2
				comp. (honhsanjiao)	5	8	1.29	19.4	8	1.29	19.4	9	1.45	21.8
				$(NH_4)_2HPO_4$	5	18	2.90	43.5	46	7.42	111.3		0.00	0.0
			26-3	$(NH_4)_2HPO_4$	13	18	7.55	113.2	46	19.29	289.4		0.00	0.0
			4-4	KH_2PO_4	0.08		0.00	0.0	52	0.13	2.0	34	0.09	1.32
			9-4	urea	23	46.3	34.35	515.3		0.00	0.0		0.00	0.0
				comp. (hongsanjiao)	31	8	8.00	120.0	8	8.00	120.0	9	9.00	135.00
				KCL	7.5		0.00	0.0		0.00	0.0	60	14.5	217.7
			29-5	comp. (jintudi)	6	18	3.48	52.2	18	3.48	52.2	18	3.48	52.2
				urea	4	46.3	5.97	89.6		0.00	0.0		0.00	0.0
			17-6	comp. (jintudi)	6	18	3.48	52.2	18	3.48	52.2	18	3.48	52.2
				urea	4	46.3	5.97	89.6		0.00	0.0		0.00	0.0

Appendix III.
Data on spring planting season 2002

Table 3.1. General data in TADC and average inputs and outputs of each greenhouse for the spring planting season 2002. A2 and A3 with fertigation system.

Greenhouse			Area		Planting	End	Number of plants			First harvest	Last harvest	Total fertilisers (kg/ha) (excluding organic manure)		
No.	Species	Variety	(mu)	(m^2)	date	date		per mu	per m^2	date	date	N-input	P_2O_5-input	K_2O-input
A2	Cucumber	Deltastar/	0.64	428.97	5-mrc-02	10-jul-02	1349	2098	3	26-3-02	14-7-02	257	344	329
		Chinese	0.16	104.39	5-mrc-02	16-jul-02	312	1994	3	31-3-02	8-7-02			
A3		Deltastar/	0.65	434.78	5-mrc-02	16-jul-02	1340	2056	3	26-3-02	7-15-02	255	342	328
		Chinese	0.15	98.8	5-mrc-02	24-jul-02	307	2073	3	3-31-02	7-12-02			
A4		Deltastar/	0.35	230.17	6-mrc-02	16-jul-02	712	2063	3	3-28-02	7-14-02	1042	601	312
		Chinese	0.10	70	6-mrc-02	16-jul-02	182	1734	3	4-3-02	7-14-02			
A11		Deltastar/	0.65	434.79	6-mrc-02	10-jul-02	1306	2004	3	4-1-02	7-11-02	607	436	254
		Chinese	0.15	98.8	6-mrc-02	13-jul-02	305	2059	3	4-3-02	7-10-02			
A14		Deltastar/	0.47	310.3	5-mrc-02	29-jun-02	945	2031	3	3-28-02	6-29-02	625	394	170
		M090/	0.09	58.18	5-mrc-02	27-may-02	186	2132	3	4-3-02	6-27-02			
		126/	0.09	58.18	5-mrc-02	28-may-02	186	2132	3	4-4-02	6-4-02			
		Muge	0.16	106.7	5-mrc-02	29-may-02	326	2038	3	4-3-02	6-29-02			

Greenhouse			Yield	Water	Pesticides	Products analysis results	
No.	Species	Variety	kg/m^2	total mm	total kg/ha	% first class	Nitrate mg/kg
A2	Cucumber	Deltastar/	7.99	300	2.51	77	292
		Chinese	6.19			96	861
A3		Deltastar/	8.21	300	3.21	81	383
		Chinese	7.06			91	384
A4		Deltastar/	8.20	733	4.17	75	300
		Chinese	5.01			81	604
A11		Deltastar/	6.28	498	5.43	77	497
		Chinese	4.42			92	359
A14		Deltastar/	5.48	543	1.79	78	635
		M090/	4.11			99	618
		126/	3.21			100	338
		Muge	3.48			93	652

Table 3.2.a. Fertilisation management (%, kg/ha) in TADC for the spring planting season 2001.

Greenhouse				Amount		kg N			kg P_2O_5			kg K_2O	
No.	Variety	Date	Type	kg	% N	per mu	per ha	% P2O5	per mu	per ha	% K20	per mu	per ha
A2	Deltstar/	5-3-02	$(NH_4)_2HPO_4$	20	18	4.50	67.5	46	11.50	172.5		0.00	0.0
	Chinese	7-4-02	KH_2PO_4	0.25		0.00	0.0	52	0.16	2.4	34	0.11	1.6
		28-6-02	KH_2PO_4	0.25		0.00	0.0	52	0.16	2.4	34	0.11	1.6
		28-6-02	urea	0.25	46.3	0.14	2.2		0.00	0.0		0.00	0.0
			fertigation			12.47	187		11.13	167.0		21.73	325.9
A3	Deltstar	5-3-02	$(NH_4)_2HPO_4$	20	18	4.50	67.5	46	11.50	172.5		0.00	0.0
		4-4-02	KH_2PO_4	0.25		0.00	0.0	52.0	0.16	2.4	34	0.11	1.6
			fertigation			12.47	187		11.13	167.0		21.73	325.9
A4	Deltstar/	6-3-02	$(NH_4)_2HPO_4$	20	18	8.00	120.0	46	20.44	306.6		0.00	0.0
	Chinese		compound	9	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			urea	6	46.3	6.17	92.6		0.00	0.0		0.00	0.0
		1-4-02	compound	9	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			urea	6	46.3	6.17	92.6		0.00	0.0		0.00	0.0
		5-4-02	KH_2PO_4	0.75		0.00	0.0	52	0.87	1.3	34	0.56	0.9
		19-4-02	compound	9	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			urea	6	46.3	6.17	92.6		0.00	0.0		0.00	0.0
			KCL	2.5		0.00	0.0		0.00	0.0	60	3.33	50.0
		30-4-02	compound	9	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			urea	7.5	46.3	7.72	115.8		0.00	0.0		0.00	0.0
			KCL	2.5		0.00	0.0		0.00	0.0	60	3.33	50.0
		13-5-02	urea	6	46.3	6.17	92.6		0.00	0.0		0.00	0.0
			$(NH_4)_2HPO_4$	9	18	3.60	54.0	46	9.2	138.0		0.00	0.0
			KCL	2.5		0.00	0.0		0.00	0.0	60	3.33	50.0
		29-5-02	compound	4.5	18	1.80	27.0	18	1.80	27.0	18	1.80	27.0
			urea	7.5	46.3	7.72	115.8		0.00	0.0		0.00	0.0
		15-6-02	compound	4.5	18	1.80	27.0	18	1.80	27.0	18	1.80	27.0
			urea	7.5	46.3	7.72	115.8		0.00	0.0		0.00	0.0

Greenhouse				Amount		kg N			kg P_2O_5			kg K_2O	
No.	Variety	Date	Type	kg	% N	per mu	per ha	% P2O5	per mu	per ha	% K20	per mu	per ha
A11	Deltstar/	6-3-02	$(NH_4)_2HPO_4$	20	18	4.50	67.5	46	11.50	172.5		0.00	0.0
	Chinese	1-4-02	compound	18	8	1.80	27.0	8	1.80	27.0	9.0	2.03	30.4
			urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
		7-4-02	KH_2PO_4	0.25		0.00	0.0	52	0.16	2.4	34.0	0.11	1.6
		25-4-02	$(NH_4)_2HPO_4$	13	18	2.93	43.9	46	7.48	112.1		0.00	0.0
			urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
			KCL	3		0.00	0.0		0.00	0.0	60.0	2.25	33.8
		3-6-02	compound	18	18	4.05	60.8	18.0	4.05	60.8	18.0	4.05	60.8
			urea	4	46.3	2.32	34.7		0.00	0.0		0.00	0.0
			KCL	3		0.00	0.0		0.00	0.0	60.0	2.25	33.8
		15-6-02	compound	18	18	4.05	60.8	18.0	4.05	60.8	18.0	4.05	60.8
			urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
			KCl	3		0.00	0.0		0.00	0.0	60.0	2.25	33.1

Greenhouse				Amount		kg N			kg P_2O_5			kg K_2O	
No.	Variety	Date	Type	kg	% N	per mu	per ha	% P2O5	per mu	per ha	% K20	per mu	per ha
A14	Deltastar/	4-3-02	$(NH_4)_2HPO_4$	25	18	5.63	84.4	46	14.38	215.6		0.00	0.0
	M090/	2-4-02	compound	18	8	1.80	27.0	8	1.80	27.	9	2.03	30.4
	126		urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
	Muge	7-4-02	KH_2PO_4	0.25		0.00	0.0	52	0.16	2.4	34	0.11	1.6
		18-4-02	$(NH_4)_2HPO_4$	10	18	2.25	33.8	46	5.75	86.3		0.00	0.0
		5-5-02	compound	13	8	1.30	19.5	8	1.30	19.5	9	1.46	21.9
			urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
		29-5-02	compound	16	8	1.60	24.0	8	1.60	24.0	9	1.80	27.0
			urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
			KCL	3		0.00	0.0		0.00	0.0	60.0	2.25	33.8
		20-6-02	compound	13	8	1.30	19.5	8	1.30	19.5	9	1.46	21.9
			urea	12	46.3	6.95	104.2		0.00	0.0		0.00	0.0
			KCL	3		0.00	0.0		0.00	0.0	60.0	2.25	33.8

Table 3.2.b. Nutrient solution applied by fertigation in the greenhouses A2 and A3 of TADC during the spring planting season 2002.

$Ca(NO_3)_2$	25.2	kg
KNO_3	15	kg
NH_4NO_3	1.5	l
EDTA-Fe	2	l
H_3PO_4	7.5	l
$MgSO_4$	13.2	kg
KNO_3	7.5	kg
$MnSO_4$	0.02145	kg
$Na_2B_4O_7$	0.08175	kg
$ZnSO_4$	0.0129	kg
$CuSO_4$	0.00255	kg
Mo	0.00189	kg

Table 3.3. Crop protection management (g/mu and g/ha) in TADC for the spring planting season 2002.

Greenhouse No.	Variety	Area (mu)	Date	Type	Amount		Specification	g/mu	g/ha
A2	Deltastar/	0,8	20-3-02	imidacloprid	20	ml	2.5%	0.63	9.4
	Chinese			kocide2000 (copper hydroxide)	40	g	77%	38.50	577.5
			25-3-02	score (difenoconazole)	50	g	10%	6.25	93.8
				kocide2000	40	g	77%	38.50	577.5
				xinzimaysu (kill bacteria)	12	g	90%	13.50	202.5
			7-4-02	score	50	g	10%	6.25	93.8
			15-4-02	agrimec	32	ml	1.8%	0.72	10.8
				actara (thiamethoxam)	16	g	25%	5.00	75.0
			26-4-02	actara	24	g	25%	7.50	112.5
				imidacloprid	32	ml	2.5%	1.00	15.0
			6-5-02	score	100	g	10%	12.50	187.5
			11-5-02	actara	24	g	25%	7.50	112.5
				agrimec	32	ml	1.8%	0.72	10.8
			8-6-02	agrimec	32	ml	1.8%	0.72	10.8
				actara	30	g	25%	9.38	140.6
				imidacloprid	40	ml	2.5%	1.25	18.8
				actara	25	g	25%	7.81	117.2
			24-6-02	actara	30	g	25%	9.38	140.6
				imidacloprid	40	ml	2.5%	1.25	18.8
				Total				167.36	2510.4

Greenhouse No.	Variety	Area (mu)	Date	Type	Amount		Specification	g/mu	g/ha
A3	Deltastar/	0,8	19-3-02	imidacloprid	20	ml	2.5%	0.63	9.4
	Chinese			kocide	40	g	77%	38.50	577.5
			25-3-02	score	32	g	10%	4.00	60.0
			2-4-02	kocide	80	g	77%	77.00	1155.0
				xinzhimaysu	12	g	90%	13.50	202.5
			10-4-02	actara	16	g	25%	5.00	75.0
				imidacloprid	32	ml	2.5%	1.00	15.0
			26-4-02	actara	24	g	25%	7.50	112.5
				imidacloprid	32	ml	2.5%	1.00	15.0
			5-5-02	actara	24	g	25%	7.50	112.5
				imidacloprid	32	ml	2.5%	1.00	15.0
			22-5-02	imidacloprid	32	ml	2.5%	1.00	15.0
				actara	12	g	25%	3.75	56.3
			30-5-02	lianmaysu	13.5	ml	72%	12.15	182.3
				actara	24	g	25%	7.50	112.5
				agrimec	32	ml	1.8%	0.72	10.8
			13-6-02	imidacloprid	32	ml	2.5%	1.00	15.0
				actara	24	g	25%	7.50	112.5
				agrimec	16	ml	1.8%	0.36	5.4
			27-6-02	cypermethrin	40	ml	16%	8.00	120.0
				score	125	g	10%	15.63	234.4
				Total	.			214.24	3212.6

Greenhouse No.	Variety	Area (mu)	Date	Type	Amount		Specification	g/mu	g/ha
A4	Deltastar/ Chinese	0,45	19-3-02	imidacloprid	10	ml	2.5%	0.56	8.33
				kocide	20	g	77%	34.22	513.3
			24-3-02	topsin	100	g	70%	155.56	2333.3
			2-4-02	kocide	6	g	77%	10.27	154.0
				xinzhimaysu	6	g	90%	12.00	180.0
			10-4-02	actara	8	g	25%	4.44	66.7
				imidacloprid	16	ml	2.5%	0.89	13.3
			16-4-02	agrimec	17	ml	1.8%	0.68	10.2
				actara	8	g	25%	4.44	66.7
			26-4-02	actara	12	g	25%	6.67	100.0
				imidacloprid	17	ml	2.5%	0.94	14.2
			5-5-02	actara	12	g	25%	6.67	100.0
				imidacloprid	16	ml	2.5%	0.89	13.3
			19-5-02	imidacloprid	16	ml	2.5%	0.89	13.3
				actara	12	g	25%	6.67	100.0
			4-6-02	agrimec	16	ml	1.8%	0.64	9.6
			7-6-02	imidacloprid	16	ml	2.5%	0.89	13.3
				actara	12	g	25%	6.67	100.0
			17-6-02	imidacloprid	16	ml	2.5%	0.89	13.3
				agrimec	16	ml	1.8%	0.64	9.6
			22-6-02	kedubao	25	g	40%	22.22	333.3
				Total				276.74	4165.4

Greenhouse No.	Variety	Area (mu)	Date	Type	Amount		Specification	g/mu	g/ha
A11	Deltastar/ Chinese	0.8	20-3-02	imidacloprid	20	ml	2.5%	0.63	9.4
				kocide	50	g	77%	48.13	721.9
			24-3-02	topsin	200	g	70%	175.00	2625.0
			10-4-02	actara	16	g	25%	5.00	75.0
			21-4-02	banqianjing	32	g	20%	8.00	120.0
			30-4-02	score	40	g	10%	5.00	75.0
				agrimec	24	ml	1.8%	0.54	8.1
			9-5-02	imidacloprid	32	ml	2.5%	1.00	15.0
			14-5-02	imidacloprid	32	ml	2.5%	1.00	15.0
			30-5-02	agrimec	32	ml	1.8%	0.72	10.8
			8-6-02	tridmefom-sulfar	150	g	50%	93.75	1406.3
				agrimec	48	ml	1.8%	1.08	16.2
			13-6-02	agrimec	32	ml	1.8%	0.72	10.8
				actara	30	g	25%	9.38	140.6
				imidacloprid	40	ml	2.5%	1.25	18.8
			24-6-02	actara	30	g	25%	9.38	140.6
				imidacloprid	40	ml	2.5%	1.25	18.8
				Total				361.83	5427.3

Greenhouse No.	Variety	Area (mu)	Date	Type	Amount		Specification	g/mu	g/ha
A14	Deltastar/	0.8	19-3-02	kocide	40	g	77%	38.50	577.5
	M090/		7-4-02	score	43	g	10%	5.38	80.6
	126/		10-4-02	actara	16	g	25%	5.00	75.0
	Muge		21-4-02	score	14	g	10%	1.75	26.3
			30-4-02	actara	24	g	25%	7.50	112.5
				agrimec	32	ml	1.8%	0.72	10.8
			25-5-02	imidacloprid	21	ml	2.5%	0.65	9.8
			29-5-02	baifenjing	100	g	20%	25.00	375.0
			7-6-02	fuxing	20	ml	40%	10.00	150.0
			13-6-02	baifenjing	100	g	20%	25.00	375.0
				Total				119.50	1792.5

Table 3.4. Irrigation management (mm) in the cucumber greenhouses of TADC for the spring planting season 2002.

	A2 (*)	A3 (*)	A4	A11	A14
6-3-02				18.75	
7-3-02				32.25	
8-3-02	8.10	8.10			
12-3-02	1.87	1.87			69.37
15-3-02	1.87	1.87			
18-3-02	1.87	1.87		53.43	
21-3-02	1.87	1.87			83.62
23-3-02	1.87	1.87			
25-3-02	1.87	1.87		17.62	
27-3-02	7.50	7.50			
28-3-02	1.87	1.87			
30-3-02	5.62	5.62			
31-3-02	2.81	2.81			
1-4-02	5.62	5.62	52.97	41.81	45.19
6-4-02	1.87	1.87			
8-4-02	1.87	1.87	24.65		
9-4-02	1.12	1.12			
10-4-02	1.12	1.12			52.68
12-4-02	1.69	1.69	75.62	50.62	
13-4-02	1.69	1.69			
15-4-02	0.56	0.56			
17-4-02	0.94	0.94			
18-4-02	1.87	1.87			31.31
19-4-02	4.69	4.69	43.64		
23-4-02	2.81	2.81			
24-4-02	3.56	3.56			
25-4-02	3.75	3.75			
26-4-02	3.56	3.56		54.93	
27-4-02	2.81	2.81			
28-4-02	0.94	0.94			
30-4-02	3.75	3.75	98.94		
2-5-02	2.81	2.81			
4-5-02	5.62	5.62			48.75
6-5-02	4.31	4.31			
8-5-02	4.50	4.50			
9-5-02	4.50	4.50			
10-5-02	1.50	1.50	62.96	56.06	
16-5-02	2.25	2.25			
18-5-02	6.00	6.00			
22-5-02	7.50	7.50			45.00
23-5-02	5.25	5.25	71.96		
25-5-02	7.50	7.50		75.00	
26-5-02	7.50	7.50			
27-5-02	9.37	9.37			51.37
28-5-02	9.37	9.37			
29-5-02	9.37	9.37	79.95		
30-5-02	9.37	9.37			
31-5-02	9.37	9.37			

	A2 (*)	A3 (*)	A4	A11	A14
2-6-02	9.37	9.37			
3-6-02	9.37	9.37		50.62	
4-6-02	9.37	9.37			36.75
5-6-02	7.50	7.50	69.96		
6-6-02	7.50	7.50			
7-6-02	9.37	9.37			
9-6-02	7.50	7.50			
10-6-02	1.50	1.50			
11-6-02	3.75	3.75			
11-6-02	3.75	3.75			37.50
13-6-02	3.75	3.75	63.30		
14-6-02	2.81	2.81			
15-6-02	0.37	0.37			
16-6-02	3.75	3.75		46.87	
17-6-02	3.75	3.75			
18-6-02	3.75	3.75	89.28		
19-6-02	2.81	2.81			
20-6-02	3.75	3.75			41.25
26-6-02	0.94	0.94			
2-7-02	2.81	2.81			
1-7-02	0.94	0.94			
3-7-02	3.75	3.75			
4-7-02	2.81	2.81			
9-7-02	2.62	2.62			
10-7-02	3.75	3.75			
11-7-02	3.75	3.75			

(*) A2 and A3 with fertigation system

Table 3.5. General data in Liu Fu and averages on inputs and outputs of each greenhouse for the spring planting season 2002.

Greenhouse			Area	Planting	End	Number of plants			First harvest
No.	Species	Variety	(mu)	(m^2) date	date		per mu	per m^2	date
N 12	Cucumber	Deltastar	0.78	520 22-Feb-01	10-Jun-02	1560	2000	3	12-Apr-02
N 14	Cucumber	Deltastar	0.78	520 24-Feb-02	10-Jun-02	1560	2000	3	12-Apr-02
N 7	Cucumber	Deltastar	0.78	520 23-Feb-02	10-Jun-02	1560	2000	3	12-Apr-02
N 9	Cucumber	Deltastar	0.78	520 24-Feb-02	10-Jun-02	1560	2000	3	2-Apr-02
N 10	Cucumber	Deltastar	0.78	520 22-Feb-02	10-Jun-02	1560	2000	3	30-Mar-02
N 11	Cucumber	Radiant	0.78	520 24-Feb-02	10-Jun-02	1560	2000	3	10-Apr-02
N 2	Cucumber	22-21	0.78	520 6-Nov-02	10-Apr-02	1560	2000	3	5-Jan-02
N 3	Cucumber	Condesa	0.78	520 10-May-02	20-Jul-02	1560	2000	3	15-Jun-02
N 8	Tomato	Melvin	0.78	520 13-Mar-02	1-Jul-02	1560	2000	3	22-May-02
N 13	Tomato	Jinan	0.78	520 8-May-02	15-Aug-02	1560	2000	3	4-Jul-02
S 4	Tomato	Jinan	0.78	520 13-Mar-02	5-Jul-02	1560	2000	3	20-May-02
S 8	Tomato	Melvin	0.78	520 13-Mar-02	5-Jul-02	1560	2000	3	20-May-02
S 0	Tomato	Beril	4.00	2668 13-Mar-02	5-Jul-02	8004	2000	3	25-May-02

Greenhouse			Yield	Irrigation	Pesticides	Total fertilisers (kg/ha) (excluding organic manure)		
No.	Species	Variety	kg/m2	total hours	total g/ha	N-input	P_2O_5-input	K_2O-input
N 12	Cucumber	Deltastar	2.21	31	3841	870	237	145
N 14	Cucumber	Deltastar	2.31	31	3240	715	191	145
N 7	Cucumber	Deltastar	2.40	31	3317	992	145	145
N 9	Cucumber	Deltastar	2.31	31	3260	725	145	145
N 10	Cucumber	Deltastar	2.21	31	3260	1193	145	145
N 11	Cucumber	Radiant	2.31	31	1784	682	191	145
N 2	Cucumber	22-21	1.44	20	8677	413	145	145
N 3	Cucumber	Condesa	1.15	15	5726	847	145	145
N 8	Tomato	Melvin	4.47	33	5115	524	145	145
N 13	Tomato	Jinan	4.04	33	4274	580	145	145
S 4	Tomato	Jinan	4.52	33	5115	580	145	145
S 8	Tomato	Melvin	4.66	33	5115	580	145	145
S 0	Tomato	Beril	4.18	110	3988	452	113	112

Table 3.6. Fertilisation management (kg/ha) in Liu Fu for the spring planting season 2002.

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P_2O_5 per ha	% K_20	kg K_2O per ha
N 12	Cucumber	Deltastar		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			9-4-02	compound fertiliser	24	63	145	40	92		0
			14-4-02	compound fertiliser	24	63	145		0		0
			21-4-02	compound fertiliser	24	63	145		0		0
			25-4-02	益农大补	10		0		0		0
			28-4-02	益农大补	10		0		0		0
			5-5-02	compound fertiliser	24	63	145		0		0
			14-5-02	compound fertiliser	24	63	145		0		0
N 14	Cucumber	Deltastar		goat manure	12000	0.65	750	0.50	577	0.25	288
				compound fertiliser	100	15	145	15	145	15	145
			19-3-02	益农大补			0		0		0
			9-4-02	硝酸磷肥	40	26.5	102	11.5	46		0
			21-4-02	urea	40	46.3	178		0		0
			25-4-02	益农大补	10		0		0		0
			28-4-02	益农大补	10		0		0		0
			5-5-02	compound fertiliser	24	63	145		0		0
			13-5-02	compound fertiliser	24	63	145		0		0
N 7	Cucumber	Deltastar	20-2-02	chicken manure	2400	1.26	290	1.31	302	0.86	198
			21-2-02	compound fertiliser	100	15	145	15	145	15	145
			19-3-02	urea	20	46.3	89		0		0
			11-4-01	compound fertiliser	24	63	145		0		0
			22-4-02	urea	40	46.3	178		0		0
			25-4-02	益农大补			0		0		0
			29-4-01	compound fertiliser	24	63	145		0		0
			2-5-01	compound fertiliser	24	63	145		0		0
			9-5-01	compound fertiliser	24	63	145		0		0
N 9	Cucumber	Deltastar		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			27-3-02	益农大补	20		0		0		0
			2-4-01	益农大补	20		0		0		0
			9-4-02	compound fertiliser	24	63	145		0		0
			19-4-02	compound fertiliser	24	63	145		0		0
			26-4-02	益农大补	10		0		0		0
			29-4-02	益农大补	10		0		0		0
			5-5-02	compound fertiliser	24	63	145		0		0
			13-5-02	compound fertiliser	24	63	145		0		0

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P_2O_5 per ha	% K_20	kg K_2O per ha
N 10	Cucumber	Deltastar		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			19-3-02	益农大补	20		0		0		0
			2-4-02	urea	20	46.3	89		0		0
			10-4-02	urea	20	46.3	89		0		0
			18-4-02	compound fertiliser	24	63	145		0		0
			25-4-02	compound fertiliser	24	63	145		0		0
			29-4-02	compound fertiliser	24	63	145		0		0
			29-4-01	compound fertiliser	24	63	145		0		0
			4-5-02	compound fertiliser	24	63	145		0		0
			15-5-02	compound fertiliser	24	63	145		0		0
N 11	Cucumber	Radiant		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15.00	145
			19-3-02	益农大补	10		0		0		0
			2-4-02	益农大补	10		0		0		0
			9-4-02	硝酸磷肥	40	26.5	102	11.5	46		0
			14-4-02	compound fertiliser	24	63	145		0		0
			19-4-02	益农大补	10		0		0		0
			26-4-02	益农大补	10		0		0		0
			5-5-02	compound fertiliser	24	63	145		0		0
			14-5-02	compound fertiliser	24	63	145		0		0
N 2	Cucumber	22-21		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			30-11-02	益农大补	10		0		0		0
			8-12-02	益农大补	10		0		0		0
			20-12-02	益农大补	10		0		0		0
			15-1-02	urea	30	46.3	134		0		0
			20-2-02	urea	30	46.3	134		0		0
			2-3-02	益农大补	10		0		0		0
N 3	Cucumber	Condesa		chicken manure	2400	1.26	290	1.31	302.31	0.86	198
				compound fertiliser	100	15	145	15	145	15.00	145
			1-6-02	urea	20	46.3	89		0		0
			13-6-02	益农大补	10		0		0		0
			20-6-02	益农大补	10		0		0		0
			24-6-02	compound fertiliser	24	63	145		0		0
			29-6-02	compound fertiliser	24	63	145		0		0
			5-7-02	compound fertiliser	24	63	145		0		0
			9-7-02	urea	20	46.3	89		0		0
			13-7-02	urea	20	46.3	89		0		0
N 8	Tomato	Melvin		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			20-4-02	益农大补	10		0		0		0
			30-4-02	urea	20	46	89		0		0
			10-5-02	compound fertiliser	24	63	145		0		0
			20-5-02	compound fertiliser	24	63	145		0		0

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P_2O_5 per ha	% K_20	kg K_2O per ha
N 13	Tomato	Jinan		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			19-4-02	益农大补	10		0		0		0
			28-4-02	compound fertiliser	24	63	145		0		0
			11-5-02	compound fertiliser	24	63	145		0		0
			25-5-02	compound fertiliser	24	63	145		0		0
S 4	Tomato	Jinan		chicken manure	2400	1.26	290	1.31	302	0.86	198
				compound fertiliser	100	15	145	15	145	15	145
			19-4-02	益农大补	10		0		0		0
			28-4-02	compound fertiliser	24	63	145		0		0
			11-5-02	compound fertiliser	24	63	145		0		0
			25-5-02	compound fertiliser	24	63	145		0		0
S 8	Tomato	Melvin		chicken manure	2400	1.26	290	1.31	302	0.86	198.46
				compound fertiliser	100	15	145	15	145	15	145
			19-4-02	益农大补	10		0		0		0
			28-4-02	compound fertiliser	24	63	145		0		0
			11-5-02	compound fertiliser	24	63	145		0		0
			25-5-02	compound fertiliser	24	63	145		0		0
S 0	Tomato	Beril		chicken manure	9600	1.26	227	1.31	236	0.86	155
				compound fertiliser	400	15	113	15	113	15	113
			20-4-02	益农大补	40		0		0		0
			30-4-02	compound fertiliser	96	63	113		0		0
			13-5-02	compound fertiliser	96	63	113		0		0
			28-5-02	compound fertiliser	96	63	113		0		0

Table 3.7. Fertiliser application in each greenhouse of Liu Fu; organic, chemical and total N,P,K-input during the spring planting season 2002.

Greenhouse			kg N /ha			kg P_2O_5/ha			kg K_2O/ha		
No.	Species	Variety	Organic manure	Chemicals total input	Total N input	Organic manure	Chemicals total input	Total P-input	Organic manure	Chemicals total input	Total K-input
N 12	Cucumber	Deltastar	291	871	1162	302	237	539	198	144	343
N 14	Cucumber	Deltastar	750	714	1464	577	188	765	288	144	433
N 7	Cucumber	Deltastar	291	991	1282	302	144	447	198	144	343
N 9	Cucumber	Deltastar	291	726	1017	302	144	447	198	144	343
N 10	Cucumber	Deltastar	291	1193	1484	302	144	447	198	144	343
N 11	Cucumber	Radiant	291	682	973	302	188	491	198	144	343
N 2	Cucumber	22-21	291	410	700	302	144	447	198	144	343
N 3	Cucumber	Condesa	291	846	1137	302	144	447	198	144	343
N 8	Tomato	Melvin	291	523	814	302	144	447	198	144	343
N 13	Tomato	Jinan	291	580	871	302	144	447	198	144	343
S 4	Tomato	Jinan	291	580	871	302	144	447	198	144	343
S 8	Tomato	Melvin	291	580	871	302	144	447	198	144	343
S 0	Tomato	Beril	227	452	679	236	112	348	155	112	267

Table 3.8. Crop protection management (g/mu and g/ha) in Liu Fu for the spring planting season 2002.

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Spec.
N 12	Cucumber	Deltastar	3-3-01	杀毒矾	100	82.1	1230.8	64%
			7-3-02	唯它灵	75	24.0	360.6	25%
			31-3-02	杀毒矾	100	82.1	1230.8	64%
			6-4-02	唯它灵	75	24.0	360.6	25%
			1-4-01	唯它灵	125	40.1	601.0	25%
			12-4-02	一遍净	30	3.8	57.7	10%
			8-5-02	爱福丁	50	0.0	0.0	
N 14	Cucumber	Deltastar	3-3-01	杀毒矾	100	82.1	1230.8	64%
			7-3-02	唯它灵	75	24.0	360.6	25%
			22-3-02	一遍净	30	3.8	57.7	10%
			30-3-02	杀毒矾	100	82.1	1230.8	64%
			12-4-02	唯它灵	75	24.0	360.6	25%
N 7	Cucumber	Deltastar	3-3-01	杀毒矾	100	82.1	1230.8	64%
			7-3-02	唯它灵	75	24.0	360.6	25%
			21-3-02	杀毒矾	100	82.1	1230.8	64%
				一遍净	30	3.8	57.7	10%
			1-4-01	一遍净	30	3.8	57.7	10%
				唯它灵	75	24.0	360.6	25%
				一遍净	10	1.3	19.2	10%
N 9	Cucumber	Deltastar	3-3-01	杀毒矾	100	82.1	1230.8	64%
			7--02	唯它灵	75	24.0	360.6	25%
			21-3-02	杀毒矾	100	82.1	1230.8	64%
			26-3-01	一遍净	20	2.6	38.5	10%
			1-4-01	一遍净	20	2.6	38.5	10%
			11-4-02	唯它灵	75	24.0	360.6	25%
N 10	Cucumber	Deltastar	3-3-01	杀毒矾	100	82.1	1230.8	64%
			7-3-02	唯它灵	75	24.0	360.6	25%
			21-3-02	一遍净	20	2.6	38.5	10%
			30-3-02	杀毒矾	100	82.1	1230.8	64%
				一遍净	20	2.6	38.5	10%
			11-4-02	唯它灵	75	24.0	360.6	25%
N 11	Cucumber	Radiant	3-3-01	杀毒矾	100	82.1	1230.8	64%
			22-3-02	一遍净	20	2.6	38.5	10%
			15-4-02	唯它灵	75	24.0	360.6	25%
				一遍净	20	2.6	38.5	10%
			23-4-02	三唑酮	30	7.7	115.4	20%
N 2	Cucumber	22-21	15-11-02	安克	60	38.5	576.9	50%
			21-11-02	霜霉净	100	97.4	1461.5	76%
			12-12-02	百腐烟剂	250	64.1	961.5	20%
			26-12-02	熏蚜虱净	250	80.1	1201.9	25%
			12-1-02	百腐烟剂	250	64.1	961.5	20%
			18-1-02	杀毒矾	100	82.1	1230.8	64%
			30-1-02	熏蚜虱净	250	80.1	1201.9	25%
			20-2-02	稳德	45	0.2	3.5	0%
			25-2-02	百腐烟剂	250	64.1	961.5	20%
			2-3-02	三唑酮	30	7.7	115.4	20%

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Spec.
N 3	Cucumber	Condesa	5-6-02	一遍净	30	3.8	57.7	10%
			12-6-02	唯它灵	75	24.0	360.6	25%
			19-6-02	杀毒矾	100	82.1	1230.8	64%
			25-6-02	霜霉净	100	97.4	1461.5	76%
			3-7-02	杀毒矾	100	82.1	1230.8	64%
			8-7-02	霜脲锰锌	100	92.3	1384.6	72%
N 8	Tomato	Melvin	2-4-01	菌必治	100	64.1	961.5	50%
			12-4-02	菌必治	100	64.1	961.5	50%
			20-4-02	菌核清	100	70.5	1057.7	55%
			30-4-02	斯特母	80	51.3	769.2	50%
			8-5-02	斯特母	80	51.3	769.2	50%
				绿芬威3号	50	39.7	596.2	62%
N 13	Tomato	Jinan	3-6-02	菌必治	100	64.1	961.5	50%
			15-6-02	代森锰锌	100	89.7	1346.2	70%
			28-6-02	绿芬威3号	50	39.7	596.2	62%
			5-7-02	绿芬威3号	50	39.7	596.2	62%
			10-7-02	斯特母	80	51.3	769.2	50%
			10-7-02	稳德	60	0.3	4.6	0%
S 4	Tomato	Jinan	2-4-01	菌必治	100	64.1	961.5	50%
			12-4-02	菌必治	100	64.1	961.5	50%
			20-4-02	菌核清	100	70.5	1057.7	55%
			30-4-02	斯特母	80	51.3	769.2	50%
			8-5-02	斯特母	80	51.3	769.2	50%
				绿芬威3号	50	39.7	596.2	62%
S 8	Tomato	Melvin	2-4-01	菌必治	100	64.1	961.5	50%
			12-4-02	菌必治	100	64.1	961.5	50%
			20-4-02	菌核清	100	70.5	1057.7	55%
			30-4-02	斯特母	80	51.3	769.2	50%
			8-5-02	斯特母	80	51.3	769.2	50%
				绿芬威3号	50	39.7	596.2	62%
S 0	Tomato	Beril	1-4-02	菌必治	400	50.0	749.6	50%
			13-4-02	菌必治	400	50.0	749.6	50%
			21-4-02	菌核清	400	55.0	824.6	55%
			29-4-02	斯特母	320	40.0	599.7	50%
			7-5-02	斯特母	320	40.0	599.7	50%
				绿芬威3号	200	31.0	464.8	62%

Table 3.9. General data in Dang Chen and averages on inputs and outputs of each greenhouse for the spring planting season 2002.

Greenhouse			Area		Planting	End	Number of plants			First	Last
No.	Species	Variety	(mu)	(m^2)	date	date		per mu	per m^2	harvest date	harvest date
No. 2-5	Tomato	Beril	0.85	570	20-May-02	3-Sep-02	1512	2000	3	25-Jul-02	31-Aug-02
No. 1-8	Tomato	Beril	0.76	504	17-May-02	25-Aug-02	1710	2000	3	25-Jul-02	25-Aug-02
No. 2-9	Tomato	Beril	0.85	570	1-May-02	4-Sep-02	1710	2000	3	10-Jul-02	2-Sep-02
No. 2-10	Tomato	Beril	0.85	570	20-May-02	4-Sep-02	1710	2000	3	25-Jul-02	3-Sep-02
No. 2-3	Tomato	Beril	0.85	570	10-May-02	31-Aug-02	1710	2000	3	18-Jul-02	30-Aug-02
No. 2-2	Tomato	Beril	0.85	570	15-May-02	31-Aug-02	1710	2000	3	22-Jul-02	31-Aug-02
No. 2-12	Tomato	Beril	0.85	570	15-May-02	4-Sep-02	1710	2000	3	24-Jul-02	4-Sep-02
No. 2-11	Tomato	Beril	0.85	570	15-May-02	4-Sep-02	1710	2000	3	24-Jul-02	4-Sep-02
No. 2-1	Tomato	Beril	0.85	570	15-May-02	31-Aug-02	1710	2000	3	25-Jul-02	31-Aug-02
No. 2-8	Tomato	Jinan	0.85	570	20-May-02	4-Sep-02	1710	2000	3	28-Jul-02	4-Sep-02
No. 1-14	Tomato	Jinan	0.76	504	10-May-02	25-Aug-02	1512	2000	3	18-Jul-02	25-Aug-02
No. 3-4	Tomato	Beril	0.85	570	10-May-02	25-Aug-02	1710	2000	3	20-Jul-02	25-Aug-02
No. 3-8	Tomato	Melvin	0.85	570	10-May-02	31-Aug-02	1710	2000	3	20-Jul-02	31-Aug-02
No. 1-1	Cucumber	Deltastar	0.76	504	v	5-Jul-02	1512	2000	3	5-Jun-02	2-Jul-02
No. 1-2	Cucumber	Radiant	0.76	504	22-Apr-02	5-Jul-02	1512	2000	3	3-Jun-02	2-Jul-02
No. 1-4	Cucumber	Condesa	0.76	504	21-Apr-02	25-Jul-02	1512	2000	3	2-Jun-02	25-Jul-02
No. 1-6	Cucumber	Deltastar	0.76	504	13-Mar-02	10-Jul-02	1512	2000	3	24-Apr-02	10-Jul-02
No. 1-7	Cucumber	Deltastar	0.76	504	12-Apr-02	15-Jul-02	1512	2000	3	20-May-02	14-Jul-02
No. 1-9	Cucumber	Deltastar	0.76	504	13-Mar-02	10-Jul-02	1512	2000	3	24-Apr-02	10-Jul-02
No. 1-10	Cucumber	Condesa	0.76	504	22-Apr-02	25-Jun-02	1512	2000	3	2-Jun-02	25-Jun-01
No. 1-11	Cucumber	Deltastar	0.76	504	29-Apr-02	5-Jul-02	1512	2000	3	8-Jun-02	4-Jul-02
No. 1-13	Cucumber	Deltastar	0.76	504	13-Apr-02	3-Aug-02	1512	2000	3	20-May-02	3-Aug-02
No. 2-4	Cucumber	Deltastar	0.85	570	21-Apr-02	25-Jul-02	1710	2000	3	2-Jun-02	25-Jul-02
No. 2-6	Cucumber	Condesa	0.85	570	22-Apr-02	25-Jun-02	1710	2000	3	3-Jun-02	25-Jun-02
No. 2-7	Cucumber	Condesa	0.85	570	22-Apr-02	25-Jun-02	1710	2000	3	2-Jun-02	25-Jun-02
No. 3-3	Cucumber	22-21	0.85	570	16-Nov-02	3-May-02	1710	2000	3	30-Dec-02	3-May-02
No. 3-7	Cucumber	Deltastar	0.85	570	18-Apr-02	28-Jul-02	1710	2000	3	26-May-02	28-Jul-02

Greenhouse No.	Species	Variety	Yield kg/m²	Pesticides total g/ha	Total fertilisers (kg/ha) (excluding organic manure)		
					N-input	P_2O_5-input	K_2O-input
No. 2-5	Tomato	Beril	4.0	2638	99	160	59
No. 1-8	Tomato	Beril	4.5	2606	166	74	74
No. 2-9	Tomato	Beril	5.1	5074	200	79	79
No. 2-10	Tomato	Beril	5.0	4666	239	180	79
No. 2-3	Tomato	Beril	3.8	4048	301	79	79
No. 2-2	Tomato	Beril	3.7	4869	301	79	79
No. 2-12	Tomato	Beril	5.6	4674	80	101	237
No. 2-11	Tomato	Beril	5.6	4605	463	101	197
No. 2-1	Tomato	Beril	3.7	6771	42	67	105
No. 2-8	Tomato	Jinan	4.9	6771	97	146	66
No. 1-14	Tomato	Jinan	4.6	2261	203	89	89
No. 3-4	Tomato	Beril	3.8	2657	180	79	79
No. 3-8	Tomato	Melvin	3.7	2305	180	79	79
No. 1-1	Cucumber	Deltastar	1.5	7895	219	60	60
No. 1-2	Cucumber	Radiant	1.6	7560	249	89	89
No. 1-4	Cucumber	Condesa	3.2	6301	582	94	94
No. 1-6	Cucumber	Deltastar	6.1	19876	818	134	357
No. 1-7	Cucumber	Deltastar	4.5	8368	607	60	193
No. 1-9	Cucumber	Deltastar	6.3	17688	917	164	387
No. 1-10	Cucumber	Condesa	1.4	5850	491	94	94
No. 1-11	Cucumber	Deltastar	1.5	11981	536	94	94
No. 1-13	Cucumber	Deltastar	5.8	29502	818	134	357
No. 2-4	Cucumber	Deltastar	2.9	14781	364	106	145
No. 2-6	Cucumber	Condesa	1.4	5421	194	53	53
No. 2-7	Cucumber	Condesa	1.6	6630	220	79	79
No. 3-3	Cucumber	22-21	2.1	9683	515	83	83
No. 3-7	Cucumber	Deltastar	5.4	27114	724	118	316

Table 3.10. Fertilisation management (kg/ha) in Dang Chen for the spring planting season 2002.

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P per ha	% K_20	kg K per ha
No. 2-5	Tomato	Beril		chicken manure	3000	1.26	332	1.31	345	0.86	226
			25-6-02	compound fertiliser	25	15	33	15	33	15	33
			15-7-02	$(NH_4)_2HPO_4$	25	18	39	46	101		0
			30-7-02	compound fertiliser	20	15	26	15	26	15	26
No. 1-8	Tomato	Beril		chicken manure	3000	1.26	375	1.31	390	0.86	256
			20-6-02	compound fertiliser	20	15	30	15	30	15	30
			30-6-02	urea	20	46	91		0		0
			20-7-02	compound fertiliser	30	15	45	15	45	15	45
No. 2-9	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			5-6-02	urea	30	46	121		0		0
			25-6-02	compound fertiliser	30	15	39	15	39	15	39
			8-7-02	compound fertiliser	30	15	39	15	39	15	39
No. 2-10	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			22-6-02	urea	30	46	121		0		0
			10-7-02	compound fertiliser	30	15	39	15	39	15	39
			25-7-02	$(NH_4)_2HPO_4$	25	18	39	46	101		0
			5-8-02	compound fertiliser	30	15	39	15	39	15	39
No. 2-3	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			13-6-02	urea	30	46	121		0		0
			28-6-02	compound fertiliser	30	15	39	15	39	15	39
			5-7-02	urea	25	46	101		0		0
			15-7-02	compound fertiliser	30	15	39	15	39	15	39
No. 2-2	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			18-6-02	urea	30	46	121		0		0
			25-6-02	compound fertiliser	30	15	39	15	39	15	39
			5-7-02	urea	25	46	101		0		0
			15-7-02	compound fertiliser	30	15	39	15	39	15	39
No. 2-12	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			20-6-02	K_2SO_4	30		0		0	45	118
				urea	5	46	20		0		0
			8-7-02	K_2SO_4	30		0		0	45	118
				urea	5	46	20		0		0
			22-7-02	$(NH_4)_2HPO_4$	25	18	39	46	101		0
No. 2-11	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			22-6-02	K_2SO_4	30		0		0	45	118
				urea	5	46	20		0		0
			10-7-02	$(NH_4)_2HPO_4$	25	18	39	46	101		0
			25-7-02	K_2SO_4	20		0		0	45	79
				urea	5		404		0		0
No. 2-1	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			20-6-02	compound fertiliser	20	15	26	15	26	15	26
			30-6-02	K_2SO_4	20		0		0	45	79
			10-7-02	$(NH_4)_2HPO_4$	10	18	16	46	40		0

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P per ha	% K_20	kg K per ha
No. 2-8	Tomato	Jinan		mixed waste	3000	0.39	103	0.18	47	0.37	97
			28-6-02	compound fertiliser	20	15	26	15	26	15	26
			15-7-02	$(NH_4)_2HPO_4$	20	18	32	46	81		0
			25-7-02	compound fertiliser	30	15	39	15	39	15	39
No. 1-14	Tomato	Jinan		mixed waste	3000	0.39	116	0.18	54	0.37	110
			13-6-02	urea	25	46	114		0		0
			25-7-02	compound fertiliser	30	15	45	15	45	15	45
			5-7-02	compound fertiliser	30	15	45	15	45	15	45
No. 3-4	Tomato	Beril		mixed waste	3000	0.39	103	0.18	47	0.37	97
			13-6-02	urea	25	46	101		0		0
			30-6-02	compound fertiliser	30	15	39	15	39	15	39
			10-7-02	compound fertiliser	30	15	39	15	39	15	39
No. 3-8	Tomato	Melvin		mixed waste	3000	0.39	103	0.18	47.	0.37	97.
			12-6-02	urea	25	46	101		0		0
			24-6-02	compound fertiliser	30	15	39	15	39	15	39
			8-7-02	compound fertiliser	30	15	39	15	39	15	39
No. 1-1	Cucumber	Deltastar		mixed waste	6000	0.39	232	0.18	107	0.37	220
			14-5-02	urea	15	46	68		0		0
			20-5-02	compound fertiliser	20	15	30	15	30	15	30
			1-6-02	urea	20	46	91		0		0
			15-6-02	compound fertiliser	20	15	30	15	30	15	30
No. 1-2	Cucumber	Radiant		chicken manure	3000	1.26	375	1.31	390	0.86	256
			15-5-02	urea	15	46	68		0		0
			22-5-02	compound fertiliser	20	15	30	15	30	15	30
			1-6-02	urea	20	46	91		0		0
			8-6-02	compound fertiliser	20	15	30	15	30	15	30
			21-6-02	compound fertiliser	20	15	30	15	30	15	30
No. 1-4	Cucumber	Condesa		chicken manure	4000	1.26	500	1.31	520	0.86	341
			13-5-02	urea	12	46	55		0		0
				compound fertiliser	13	15	19	15	19	15	19
			30-5-02	urea	25	46	114		0		0
			8-6-02	urea	20	46	91		0		0
			15-6-02	compound fertiliser	20	15	30	15	30	15	30
			21-6-02	urea	20	46	91		0		0
			30-6-02	compound fertiliser	30	15	45	15	45	15	45
			8-7-02	urea	30	46	137		0		0

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P per ha	% K_20	kg K per ha
No. 1-6	Cucumber	Deltastar		chicken manure	3000	1.26	375	1.31	390	0.86	256
				duck manure	3000	1.26	375	1.31	390	0.86	256
			2-4-02	urea	20	46	91		0		0
			10-4-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			18-4-02	compound fertiliser	30	15	45	15	45	15	45
			25-4-02	urea	10	46	46		0		0
			1-5-02	K_2SO_4	10		0		0	45	45
			15-5-02	urea	20	46	91		0		0
			22-5-02	urea	20	46	91		0		0
			1-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			7-6-02	compound fertiliser	30	15	45	15	45	15	45
				urea	20	46	91		0		0
			15-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			22-6-02	compound fertiliser	30	15	45	15	45	15	45
				urea	20	46	91		0		0
			30-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
No. 1-7	Cucumber	Deltastar		chicken manure	4000	1.26	500	1.31	520	0.86	341
			2-5-02	urea	20	46	91		0		0
			10-5-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			18-5-02	compound fertiliser	20	15	30	15	30	15	30
			25-5-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			1-6-02	urea	20	46	91		0		0
			7-6-02	urea	20	46	91		0		0
			15-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			22-6-02	compound fertiliser	20	15	30	15	30	15	30
			1-7-02	urea	20	46	91		0		0
			8-7-02	urea	10	46	46		0		0

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P per ha	% K_20	kg K per ha
No. 1-9	Cucumber	Deltastar		mixed waste	6000	0.39	232	0.18	107	0.37	220
			1-4-02	urea	15	46	68		0		0
			7-4-02	compound fertiliser	20	15	30	15	30	15	30
			15-4-02	urea	20	46	91		0		0
			25-4-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			1-4-02	compound fertiliser	30	15	45	15	45	15	45
			7-5-02	urea	10	46	46		0		0
			15-5-02	K_2SO_4	10		0		0	45	45
				urea	20	46	91		0		0
			22-5-02	urea	20	46	91		0		0
			1-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			7-6-02	compound fertiliser	30	15	45	15	45	15	45
				urea	20	46	91		0		0
			15-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			22-6-02	compound fertiliser	30	15	45	15	45	15	45
				urea	20	46	91		0		0
			30-J6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
No. 1-10	Cucumber	Condesa		mixed waste	6000	0.39	232	0.18	107	0.37	220
			13-5-02	urea	12	46	55		0		0
				compound fertiliser	13	15	19	15	19	15	19
			20-5-02	urea	25	46	114		0		0
			27-5-02	compound fertiliser	20	15	30	15	30	15	30
			5-6-02	urea	20	46	91		0		0
				compound fertiliser	30	15	45	15	45	15	45
			15-6-02	urea	30	46	137		0		0
No. 1-11	Cucumber	Deltastar		mixed waste	6000	0.39	232	0.18	107	0.37	220
			20-5-02	urea	12	46	55		0		0
			28-5-02	compound fertiliser	13	15	19	15	19	15	19
				urea	25	46	114		0		0
			5-6-02	urea	20	46	91		0		0
				compound fertiliser	20	15	30	15	30	15	30
			18-6-02	urea	20	46	91		0		0
			25-6-02	compound fertiliser	30	15	45	15	45	15	45
				urea	20	46	91		0		0

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P per ha	% K_20	kg K per ha
No. 1-13	Cucumber	Deltastar		mixed waste	4000	0.39	155	0.18	71	0.37	147
			5-5-02	urea	20	46	91		0		0
			11-5-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			16-5-02	compound fertiliser	30	15	45	15	45	15	45
			22-5-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			30-5-02	urea	20	46	91		0		0
			8-6-02	urea	20	46	91		0		0
			15-6-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			21-6-02	compound fertiliser	30	15	45	15	45	15	45
			28-6-02	urea	20	46	91		0		0
			5-7-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
			12-7-02	compound fertiliser	30	15	45	15	45	15	45
			18-7-02	urea	20	46	91		0		0
			25-7-02	urea	10	46	46		0		0
				K_2SO_4	10		0		0	45	45
No. 2-4	Cucumber	Deltastar		mixed waste	8000	0.39	274	0.18	126	0.37	260
			10-5-02	compound fertiliser	20	15	26	15	26	15	26
				$(NH_4)_2HPO_4$	10	18	16	46	40		0
			22-5-02	urea	30	46	121		0		0
			29-5-02	urea	10	46	40		0		0
				K_2SO_4	10		0		0	45	39
			12-6-02	compound fertiliser	30	15	39	15	39	15	39
			18-6-02	urea	10	46	40		0		0
				K_2SO_4	10		0		0	45	39
			25-6-02	urea	20	46	81		0		0
No. 2-6	Cucumber	Condesa		mixed waste	6000	0.39	205	0.18	95	0.37	195
			13-5-01	urea	15	46	61		0		0
			22-5-02	compound fertiliser	20	15	26	15	26	15	26
			1-6-01	urea	20	46	81		0		0
			15-6-02	compound fertiliser	20	15	26	15	26	15	26
No. 2-7	Cucumber	Condesa		mixed waste	6000	0.39	205	0.18	95	0.37	195
			12-5-02	urea	15	46	61		0		0
			20-5-02	compound fertiliser	20	15	26	15	26	15	26
			28-5-02	urea	20	46	81		0		0
			7-6-02	compound fertiliser	20	15	26	15	26	15	26
			16-6-02	compound fertiliser	20	15	26	15	26	15	26

Greenhouse No.	Species	Variety	Date	Type	Amount pound (1/2 kg)	% N	kg N per ha	% P_2O_5	kg P per ha	% K_20	kg K per ha
No. 3-3	Cucumber	22-21		mixed waste	6000	0.39	205	0.18	95	0.37	195
			15-12-02	urea	12	46	48		0		0
				compound fertiliser	13	15	17	15	17	15	17
			31-12-02	urea	25	46	101		0		0
			15-1-02	urea	20	46	81		0		0
			8-2-01	compound fertiliser	20	15	26	15	26	15	26
			24-2-02	urea	20	46	81		0		0
			15-3-02	compound fertiliser	30	15	39	15	39	15	39
			5-4-02	urea	30	46	121		0		0
No. 3-7	Cucumber	Deltastar		mixed waste	8000	0.39	274	0.18	126	0.37	260
			6-5-02	urea	20	46	81		0		0
			13-5-02	urea	10	46	40		0		0
				K_2SO_4	10		0		0	45	39
			19-5-02	compound fertiliser	30	15	39	15	39	15	39
			25-5-02	urea	10	46	40		0		0
			1-6-02	K_2SO_4	10		0		0	45	39
			7-6-02	urea	20	46	81		0		0
			13-6-02	urea	20	46	81		0		0
			19-6-02	urea	10	46	40		0		0
			25-6-02	K_2SO_4	10		0		0	45	39
			1-7-02	compound fertiliser	30	15	39	15	39	15	39
				urea	20	46	81		0		0
			7-7-02	urea	10	46	40		0		0
				K_2SO_4	10		0		0	45	39
			13-7-02	compound fertiliser	30	15	39	15	39	15	39
				urea	20	46	81		0		0
			20-7-02	urea	10	46	40		0		0
				K_2SO_4	10		0		0	45	39

Table 3.11. Fertiliser application in each greenhouse of Dang Chen; organic, chemical and total N,P,K input during the spring planting season 2002.

Greenhouse			kg N /ha			kg P_2O_5/ha			kg K_2O/ha		
Number	Species	Variety	Organic manure	Chemicals total input	Total N-input	Organic manure	Chemicals total-input	Total P_2O_5-input	Organic manure	Chemicals total input	Total K_2O-input
No. 2-5	Tomato	Beril	332	99	430	345	160	505	226	59	286
No. 1-8	Tomato	Beril	375	166	541	390	74	464	256	74	330
No. 2-9	Tomato	Beril	103	200	303	47	79	126	97	79	176
No. 2-10	Tomato	Beril	103	239	342	47	180	227	97	79	176
No. 2-3	Tomato	Beril	103	301	404	47	79	126	97	79	176
No. 2-2	Tomato	Beril	103	301	404	47	79	126	97	79	176
No. 2-12	Tomato	Beril	103	80	182	47	101	148	97	237	334
No. 2-11	Tomato	Beril	103	463	566	47	101	148	97	197	295
No. 2-1	Tomato	Beril	103	42	145	47	67	114	97	105	203
No. 2-8	Tomato	Jinan	103	97	200	47	146	194	97	66	163
No. 1-14	Tomato	Jinan	116	203	319	54	89	143	110	89	199
No. 3-4	Tomato	Beril	103	180	282	47	79	126	97	79	176
No. 3-8	Tomato	Melvin	103	180	282	47	79	126	97	79	176
No. 1-1	Cucumber	Deltastar	232	219	451	107	60	167	220	60	280
No. 1-2	Cucumber	Radiant	375	249	624	390	89	479	256	89	345
No. 1-4	Cucumber	Condesa	500	582	1082	520	94	614	341	94	435
No. 1-6	Cucumber	Deltastar	750	818	1568	780	134	914	512	357	869
No. 1-7	Cucumber	Deltastar	500	607	1107	520	60	579	341	193	535
No. 1-9	Cucumber	Deltastar	232	917	1149	107	164	271	220	387	607
No. 1-10	Cucumber	Condesa	232	491	723	107	94	201	220	94	314
No. 1-11	Cucumber	Deltastar	232	536	769	107	94	201	0	94	94
No. 1-13	Cucumber	Deltastar	155	818	973	71	134	205	147	357	504
No. 2-4	Cucumber	Deltastar	274	364	638	126	106	232	260	145	404
No. 2-6	Cucumber	Condesa	205	194	399	95	53	147	195	53	247
No. 2-7	Cucumber	Condesa	205	220	425	95	79	174	195	79	274
No. 3-3	Cucumber	22-21	205	515	720	95	83	178	195	83	278
No. 3-7	Cucumber	Deltastar	274	724	997	126	118	245	260	316	575

Table 3.12. Crop protection management (g/mu and g/ha) in Dang Chen for the spring planting season 2002.

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Specification
No. 2-5	Tomato	Beril	5-6-02	齐螨素	20	0.4	6.3	2%
				绿芬威3号	50	36.3	543.9	62%
			15-6-02	菌必治	50	29.2	438.6	50%
			25-6-02	百腐烟剂	100	23.4	350.9	20%
			30-6-02	稳得	60	28.1	421.1	40%
			6-7-02	菌必治	100	58.5	877.2	50%
No. 1-8	Tomato	Beril	30-5-02	齐螨素	20	0.5	7.1	2%
				绿芬威3号	50	41.0	615.1	62%
			15-6-02	绿芬威3号	50	41.0	615.1	62%
				菌必治	50	33.1	496.0	50%
			20-6-02	百腐烟剂	100	26.5	396.8	20%
			25-6-02	稳得	60	31.7	476.2	40%
No. 2-9	Tomato	Beril	20-5-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			30-5-01	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			17-6-01	稳德	60	28.1	421.1	40%
				绿芬威3号	75	54.4	815.8	62%
			25-6-01	一遍净	40	4.7	70.2	10%
				绿芬威3号	75	54.4	815.8	62%
			3-7-02	稳德	60	0.3	4.2	0%
No. 2-10	Tomato	Beril	2-6-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			15-6-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			25-6-02	稳德	60	0.3	4.2	0%
				绿芬威3号	75	54.4	815.8	62%
			2-7-02	一遍净	40	4.7	70.2	10%
				绿芬威3号	75	54.4	815.8	62%
			10-7-02	齐螨素	40	0.8	12.6	2%
No. 2-3	Tomato	Beril	30-5-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			8-6-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			15-6-02	齐螨素	30	0.6	9.5	2%
			25-6-01	农哈哈	40	0.2	3.5	1%
				绿芬威3号	100	72.5	1087.7	62%
No. 2-2	Tomato	Beril	24-5-01	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			31-5-01	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			10-6-01	绿芬威3号	75	54.4	815.8	62%
				齐螨素	30	0.6	9.5	2%
			18-6-01	稳德	60	0.3	4.2	0%
				绿芬威3号	100	72.5	1087.7	62%
			1-7-02	稳德	60	0.3	4.2	0%

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Specification
No. 2-12	Tomato	Beril	30-5-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			8-6-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			15-6-02	一遍净	40	4.7	70.2	10%
				绿芬威3号	75	54.4	815.8	62%
			25-6-02	齐螨素	40	0.8	12.6	2%
				绿芬威3号	75	54.4	815.8	62%
			7-7-02	虫螨克星	40	0.8	12.6	2%
No. 2-11	Tomato	Beril	30-5-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			10-6-02	菌必治	75	43.9	657.9	50%
				绿芬威3号	75	54.4	815.8	62%
			17-6-02	齐螨素	30	0.6	9.5	2%
				绿芬威3号	75	54.4	815.8	62%
			25-6-02	稳德	60	0.3	4.2	0%
				绿芬威3号	75	54.4	815.8	62%
			15-7-02	虫螨克星	40	0.8	12.6	2%
No. 2-1	Tomato	Beril	31-5-02	菌必治	75	43.9	657.9	50%
				好帮手	200	128.7	1929.8	55%
				绿芬威	75	52.6	789.5	60%
			10-6-02	菌必治	75	43.9	657.9	50%
				好帮手	200	128.7	1929.8	55%
				绿芬威	75	52.6	789.5	60%
			20-6-02	阿维虫清	40	0.8	12.6	2%
			30-6-02	稳德	60	0.3	4.2	0%
No. 2-8	Tomato	Jinan	5-6-02	菌必治	75	43.9	657.9	50%
				好帮手	200	128.7	1929.8	55%
				绿芬威	75	52.6	789.5	60%
			15-6-02	菌必治	75	43.9	657.9	50%
				好帮手	200	128.7	1929.8	55%
				绿芬威	75	52.6	789.5	60%
			22-6-02	齐螨素	40	0.8	12.6	2%
			30-6-02	稳德	60	0.3	4.2	0%
No. 1-14	Tomato	Jinan	27-5-01	绿芬威3号	75	61.5	922.6	62%
			5-6-02	绿芬威3 号	75	61.5	922.6	62%
			7-6-01	百腐	100	26.5	396.8	20%
			16-6-01	阿维虫清	40	1.0	14.3	2%
			3-7-01	稳德	60	0.3	4.8	0%
No. 3-4	Tomato	Beril	24-5-02	绿芬威3号	75	54.4	815.8	62%
			1-6-02	绿芬威3 号	75	54.4	815.8	62%
				菌必治	75	43.9	657.9	50%
			7-6-01	百腐	100	23.4	350.9	20%
			16-6-01	阿维虫清	40	0.8	12.6	2%
			30-6-02	稳德	60	0.3	4.2	0%

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Specification
No. 3-8	Tomato	Melvin	30-5-02	齐螨素	20	0.4	6.3	2%
				绿芬威3号	50	36.3	543.9	62%
			15-6-02	绿芬威3号	50	36.3	543.9	62%
				菌必治	50	29.2	438.6	50%
			20-6-02	百腐烟剂	100	23.4	350.9	20%
			25-6-02	稳得	60	28.1	421.1	40%
No. 1-1	Cucumber	Deltastar	5-5-02	百菌清	90	89.3	1339.3	75%
			26-5-01	霜霉净	100	100.5	1507.9	76%
			2-6-01	霜脲锰锌	120	114.3	1714.3	72%
			9-6-01	代森锰锌	120	111.1	1666.7	70%
			16-6-01	代森锰锌	120	111.1	1666.7	70%
No. 1-2	Cucumber	Radiant	8-5-02	一遍净	100	13.2	198.4	10%
				百菌清	100	99.2	1488.1	75%
			20-5-02	代森锰锌	120	111.1	1666.7	70%
			1-6-02	霜霉净	100	100.5	1507.9	76%
			7-6-02	杀毒矾	100	84.7	1269.8	64%
			15-6-02	霜脲锰锌	100	95.2	1428.6	72%
No. 1-4	Cucumber	Condesa	21-5-01	齐螨素	20	0.5	7.1	2%
			21-5-01	绿芬威1、2号	50	38.4	575.4	58%
			26-5-01	绿芬威1、2号	75	57.5	863.1	58%
			26-5-01	霜霉净	100	100.5	1507.9	76%
			10-6-01	代森锰锌	120	111.1	1666.7	70%
			17-6-01	代森锰锌	121	112.0	1680.6	70%
No. 1-6	Cucumber	Deltastar	5-4-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			15-4-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
			25-4-02	代森锰锌	45	41.7	625.0	70%
				霜霉净	45	44.6	669.6	75%
				齐螨素	21	0.5	7.5	2%
			6-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			15-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			28-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			10-6-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
			15-6-02	霜霉净	100	100.5	1507.9	76%
				绿芬威	75	59.5	892.9	60%
			30-6-01	代森锰锌	120	111.1	1666.7	70%
				绿芬威	100	79.4	1190.5	60%

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Specification
No. 1-7	Cucumber	Deltastar	1-5-02	齐螨素	20	0.5	7.1	2%
			7-5-01	霜克	1000	66.1	992.1	5%
			14-5-01	齐螨素	20	0.5	7.1	2%
				霜克	1000	66.1	992.1	5%
			20-5-01	甲霜灵	90	29.8	446.4	25%
				绿菜宝2号	45	13.7	205.4	23%
			26-5-01	绿芬威1、2号	75	57.5	863.1	58%
				霜霉净	100	100.5	1507.9	76%
			10-6-01	代森锰锌	120	111.1	1666.7	70%
			17-6-01	代森锰锌	121	112.0	1680.6	70%
No. 1-9	Cucumber	Deltastar	2-4-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			18-4-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
			25-4-02	代森锰锌	45	41.7	625.0	70%
				霜霉净	45	44.6	669.6	75%
				齐螨素	21	0.5	7.5	2%
			3-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			11-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			18-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			25-5-02	霜霉净	100	100.5	1507.9	76%
				绿芬威	75	59.5	892.9	60%
			1-6-02	代森锰锌	120	111.1	1666.7	70%
				绿芬威	100	79.4	1190.5	60%
No. 1-10	Cucumber	Condesa	7-5-01	霜霉净	100	100.5	1507.9	76%
			13-5-02	杀毒矾	100	84.7	1269.8	64%
			20-5-02	霜脲锰锌	100	95.2	1428.6	72%
			25-5-02	霜克	1000	66.1	992.1	5%
			1-6-02	甲霜灵	90	29.8	446.4	25%
			8-6-02	绿菜宝2号	45	13.7	205.4	23%
No. 1-11	Cucumber	Deltastar	5-6-01	一遍净	100	13.2	198.4	10%
			12-6-01	百菌清	100	99.2	1488.1	75%
			19-6-01	代森锰锌	120	111.1	1666.7	70%
			25-6-01	霜霉净	100	100.5	1507.9	76%
			3-7-01	杀毒矾	100	84.7	1269.8	64%

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Specification
No. 1-13	Cucumber	Deltastar	2-5-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
			9-5-02	代森锰锌	45	41.7	625.0	70%
				霜霉净	45	44.6	669.6	75%
				齐螨素	21	0.5	7.5	2%
			17-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			23-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			30-5-02	百菌清	45	44.6	669.6	75%
				霜霉净	45	45.2	678.6	76%
				绿芬威	75	59.5	892.9	60%
				齐螨素	21	0.5	7.5	2%
			5-6-02	代森锰锌	45	41.7	625.0	70%
				百菌清	45	44.6	669.6	75%
				绿芬威	75	59.5	892.9	60%
			15-6-02	霜霉净	100	100.5	1507.9	76%
				绿芬威	75	59.5	892.9	60%
			22-6-02	代森锰锌	120	111.1	1666.7	70%
				绿芬威	100	79.4	1190.5	60%
			29-6-02	百菌清	120	119.0	1785.7	75%
				绿芬威	100	79.4	1190.5	60%
			5-7-02	百菌清	60	59.5	892.9	75%
				霜霉净	60	60.3	904.8	76%
				绿芬威	100	79.4	1190.5	60%
			12-7-02	代森锰锌	60	55.6	833.3	70%
				百菌清	60	59.5	892.9	75%
			20-7-02	霜霉净	120	120.6	1809.5	76%
			25-7-02	霜脲锰锌	100	95.2	1428.6	72%
				绿芬威	75	59.5	892.9	60%
No. 2-4	Cucumber	Deltastar	8-5-02	百菌清	90	78.9	1184.2	75%
			16-5-02	霜霉净	100	88.9	1333.3	76%
			25-5-02	霜脲锰锌	120	101.1	1515.8	72%
			5-6-02	代森锰锌	120	98.2	1473.7	70%
			13-6-02	代森锰锌	120	98.2	1473.7	70%
			20-6-02	代森锰锌	120	98.2	1473.7	70%
				绿芬威	100	70.2	1052.6	60%
			27-6-02	百菌清	120	105.3	1578.9	75%
				绿芬威	100	70.2	1052.6	60%
			5-7-02	百菌清	60	52.6	789.5	75%
				霜霉净	60	53.3	800.0	76%
				绿芬威	100	70.2	1052.6	60%

Greenhouse No.	Species	Variety	Date	Type	Amount (ml) (g)	g/mu	g/ha	Specification
No. 2-6	Cucumber	condesa	5-5-02	一遍净	100	11.7	175.4	10%
			12-5-02	百菌清	100	87.7	1315.8	75%
			19-5-02	代森锰锌	120	98.2	1473.7	70%
			25-5-02	霜霉净	100	88.9	1333.3	76%
			3-6-02	杀毒矾	100	74.9	1122.8	64%
No. 2-7	Cucumber	condesa	5-5-02	百菌清	90	78.9	1184.2	75%
			15-5-02	霜霉净	100	88.9	1333.3	76%
			25-5-02	霜脲锰锌	120	101.1	1515.8	72%
			1-6-02	代森锰锌	120	98.2	1473.7	70%
			7-6-02	杀毒矾	100	74.9	1122.8	64%
No. 3-3	Cucumber	22-21	12-12-02	霜霉净	100	88.9	1333.3	76%
			26-12-02	百腐烟剂	250	58.5	877.2	20%
			12-1-02	熏蚜虱净	250	73.1	1096.5	25%
			18-1-02	百腐烟剂	250	58.5	877.2	20%
			30-1-02	杀毒矾	100	74.9	1122.8	64%
				绿芬威	100	70.2	1052.6	60%
			20-2-02	熏蚜虱净	250	73.1	1096.5	25%
			28-2-02	稳德	45	0.2	3.2	0%
			8-3-02	百腐烟剂	250	58.5	877.2	20%
			15-3-02	三唑酮	30	7.0	105.3	20%
			25-3-02	百腐烟剂	250	58.5	877.2	20%
			15-4-02	一遍净	20	2.3	35.1	10%
No. 3-7	Cucumber	deltastar	5-5-02	百菌清	120	105.3	1578.9	75%
				绿芬威	100	70.2	1052.6	60%
			13-5-02	百菌清	60	52.6	789.5	75%
				霜霉净	60	53.3	800.0	76%
				绿芬威	100	70.2	1052.6	60%
			20-5-02	代森锰锌	60	49.1	736.8	70%
				百菌清	60	52.6	789.5	75%
				霜霉净	120	106.7	1600.0	76%
			30-5-02	百菌清	120	105.3	1578.9	75%
				霜脲锰锌	100	84.2	1263.2	72%
				绿芬威	75	52.6	789.5	60%
			7-6-02	百菌清	90	78.9	1184.2	75%
			15-6-02	霜霉净	100	88.9	1333.3	76%
			22-6-02	百菌清	60	52.6	789.5	75%
				霜霉净	60	53.3	800.0	76%
				绿芬威	100	70.2	1052.6	60%
			30-6-02	霜霉净	100	88.9	1333.3	76%
				绿芬威	75	52.6	789.5	60%
			5-7-02	代森锰锌	120	98.2	1473.7	70%
				绿芬威	100	70.2	1052.6	60%
			11-7-02	百菌清	120	105.3	1578.9	75%
				绿芬威	100	70.2	1052.6	60%
			18-7-02	百菌清	60	52.6	789.5	75%
				霜霉净	60	53.3	800.0	76%
				绿芬威	100	70.2	1052.6	60%

Appendix IV.

Data on soil, water and groundwater analyses

Table 4.1. Soil and water sample analyses for the year 2001.

	Location	Greenhouse No.	Date dd/mm/yr	NO_3-N mg/kg soil	NH_4-N mg/kg soil	Total N mg/kg soil	Available P mg/kg soil	Available K mg/kg soil	pH	EC(ms/cm)
SOIL	TADC	A2	19-2-01	152.9	8.4	1880	195.3	412	8.17	0.47
	TADC	A3	19-2-01	67.8	4.7	2410	154.9	390	8.25	0.38
	TADC	A4	19-2-01	257.3	21.0	1630	109.6	280	8.15	0.67
	TADC	A5	19-2-01	221.8	9.4	1910	143.3	315	8.00	0.58
	TADC	A6	19-2-01	139.8	9.0	1640	178.0	350	8.21	0.40
	TADC	A9	19-2-01	83.4	4.7					
	TADC	A11	19-2-01	86.7	4.7	1630	123.5	330	8.37	0.40
	TADC	A14	19-2-01	122.2	13.1	1340	1.63	182	8.27	0.68
	TADC	B2	19-2-01	151.6	6.3	1580	123.6	290	8.19	0.43
	TADC	C4	19-2-01	160.2	6.3	1490	71.6	325	8.28	0.39
	TADC	East right10	19-2-01	152.2	5.0					
	TADC	East left6	19-2-01	181.4	6.9	1560	69.0	330	8.18	0.79
	TADC	East right3	19-2-01	186.6	6.3					
	TADC	B4	23-4-01	133.2	5.2	1720	95.3	320	8.33	0.56
	TADC	A12	23-4-01	65.3	2.7	1310	44.4	375	8.36	0.47
	TADC	B1	23-4-01			9760	177.3	2500		
	TADC	A3	28-4-01	0.0	11.4					
	TADC	A4	28-4-01	7.8	8.4					
	TADC	A5	28-4-01	10.0	513.1					
	TADC	A3	29-5-01	137.4	11.6					
	TADC	A4	29-5-01	174.8	7.9					
	TADC	A5	29-5-01	283.6	59.6					
	TADC	A3	3-7-01	90.2	7.1					
	TADC	A4	3-7-01	144.5	5.9					
	TADC	A5	3-7-01	167.7	5.7					
WATER	TADC	Well	23-4-01	0					8.71	0.89
SOIL	Dang Chen	Line1-9	19-4-01	9.2	12.9	1130	17.9	195	8.06	1.11
	Dang Chen	Line1-6	19-4-01	9.6	9.4	1300	31.8	199	8.13	0.46
	Dang Chen	Line1-8	19-4-01	11.2	23.2	1240	19.1	172	8.30	0.46
	Dang Chen	Line2-1	19-4-01	11.0	9.8	1200		280	8.31	0.57
	Dang Chen	Line2-14	19-4-01	10.8	46.6	1280	55.2	244	8.33	0.40
	Dang Chen	Line3-1	19-4-01	11.9	35.1	1380	22.8	181	8.28	0.37
	Dang Chen	Line3-3	19-4-01	12.0	15.8	1260	14.1	163	8.35	0.44
	Dang Chen	Well	21-4-01	0.0					7.67	2.44
WATER	Dang Chen	River	23-5-01	135.4(mg/l)					7.75	4.02
	Dang Chen	Shallow well	23-5-01	5.08(mg/l					7.51	5.80(6.021)
	Dang Chen	Deep well	23-5-01	15.5(mg/l)					7.73	5.15

	Location	Greenhouse No.	Date	NO_3-N mg/kg soil	NH_4-N mg/kg soil	Total N mg/kg soil	Available P mg/kg soil	Available K mg/kg soil	pH	EC(ms/cm)
SOIL	Liu Fu	S1	26-4-01	0.0	1.1	1260	103.6	126	8.35	0.16
	Liu Fu	S3	7-3-01	81.6	6.6	1630	93.8	189	8.17	0.41
	Liu Fu	S4	26-4-01	18.9	2.3	1620	196.6	158	8.09	0.38
	Liu Fu	S5	26-4-01	9.6	1.9	1520	198.3	158	8.09	0.31
	Liu Fu	Lian	19-4-01	32.4	3.2	1270	61.0	228	8.23	1.10
	Liu Fu	S7	26-4-01	224.6	13.0	1710	143.1	189	8.08	0.85
	Liu Fu	S9	23-2-01	135.6	10.8	2060	384.8	286	8.03	0.76
	Liu Fu	S10	23-2-01	59.8	6.5	1390	128.1	147	8.19	0.62
	Liu Fu	S11	7-3-01	18.9	5.1	1770	151.8	184	8.12	0.43
	Liu Fu	S12	7-3-01	46.2	2.5	1750	260.9	235	8.18	0.59
	Liu Fu	N3	7-3-01	143.8	39.3	1170	199.4	338	8.22	0.79
	Liu Fu	N7	26-4-01	5.3	1.3	1480	130.2	137	8.32	0.17
	Liu Fu	N10	7-3-01	134.6	91.6	1720	269.3	441	8.14	0.74
	Liu Fu	N15	7-3-01	117.5	176.1	2010	270.8	215	8.12	0.97
	Liu Fu	No. 4	19-4-01	3.8	174.6	1400	103.6	211	8.02	0.46
	Liu Fu	No. 10	19-4-01	10.6	114.2	1530		232	8.17	0.31
	Liu Fu	No. 18	19-4-01	22.4	27.8	1550	44.9	254	8.21	0.65
WATER	Liu Fu	Well N	23-2-01	13.3(mg/l)					7.44	3.71(3.189)
	Liu Fu	Well S	23-2-01	23.0(mg/l)					7.87	3.25(2.714)

Table 4.2. Results of heavy metal analyses in soil (for the spring season 2001).

No.	No. of GH.	Pb mg/kg	Cd mg/kg	Cr mg/kg	As mg/kg	Hg mg/kg
D-9	DC Line2-14	42.0	0.218	57.5	17.5	0.145
D-12	DC Line3-3	47.3	0.237	60.2	17.0	0.060
D-13	DC Line1-6	42.6	0.188	56.0	16.8	0.055
L-23	LF out 10	48.0	0.315	66.5	17.8	0.112
L-24	LF S11	52.3	0.426	53.4	16.9	0.199
L-25	LF out4	45.1	0.246	84.4	17.1	0.235
L-27	LF S3	43.0	0.282	91.1	14.9	0.168
Y-20	TADC A4	48.3	0.434	53.1	15.8	0.118
Y-21	TADC A3	50.8	0.781	55.1	13.3	0.241
Y-26	TADC A5	51.6	0.576	47.2	16.6	0.432

Standards of soil quality for pollution-free vegetable production

		p H 6.5-7.5	p H >7.5
Total Hg	(mg/kg)	≤ 0.5	1.0
Total As	(mg/kg)	≤ 30	25
Total Pb	(mg/kg)	≤ 150	150
Total Cd	(mg/kg)	≤ 0.3	0.6
Total Cr	(mg/kg)	≤ 200	250

Table 4.3. Soil sample analyses for the year 2002.

Location	Greenhouse no. and depth (cm)	mg/kg (dry base) NH_4-N 8-3-02	NO_3-N 8-3-02	NH_4-N 17-7-02	NO_3-N 17-7-02
TADC	A2(0-20)	34.0	317	2.18	684
	A2(20-40)	45.1	210	6.65	623
	A3(0-20)	41.9	117	2.19	260
	A3(20-40)	13.9	94.3	7.59	216
	A4(0-20)	62.3	377	2.97	349
	A4(20-40)	114	338	2.28	214
	A11(0-20)	9.92	208	6.11	572
	A11(20-40)	11.3	155	5.93	235
	A14(0-20)	69.2	240	2.45	253
	A14(20-40)	126	241	2.04	200
Dang Chen	no. 1-13			2.57	0
	no. 1-12			1.80	43.8
	no. 1-10			2.28	429
	no. 1-9			2.19	70.6
	no.1-7			1.79	31.5
	no. 1-6			2.23	81.6
	no. 1-4			2.66	10.3
	no. 1-2			3.09	145
	no. 1-1			2.38	91.8
	no. 3-8			10.5	293
	no. 3-3			1.71	61.5
	no. 2-6			2.20	170.3
	no. 2-4			2.73	20.3
Liu Fu	N9			2.27	64.5
	N2			1.97	27.0
	N11			12.7	79.0
	N14			2.98	36.0
	N12			2.21	123

Table 4.4. Groundwater analyses at TADC greenhouses, 2002.

Greenhouse No.	NO_3-N (mg/L) 18-3-02	16-7-02	p H	EC(ms/cm)
A2 inside	110	112	7.45	1.90
A2 outside	13.9	103	7.20	4.02
A3 inside	155	82.7	7.32	2.21
A3 outside	8.93	2.8	7.21	3.95
A4 inside	135	42	7.44	1.93
A4 outside	14.4	8.7	7.19	3.31
A11 inside	207	204	7.25	4.00
A11 outside	20.6	4.2	7.29	4.64
A14 inside	155	234	7.36	3.24
A14 outside	14.6	37.8	7.49	2.14

Appendix V.
Data on plant and product analyses

Table 5.1. Results of product analyses (fruit quality) for the year 2001. Percentage of sugar, vitamin C (mg/100g), nitrate (mg/kg) and percentage of dry matter of the fruits.

Location	Greenhouse No.	Date (dd-mm-yy)	Crop	Sugar (%)	Vitamin C (mg/100g)	Nitrate (mg/kg)	Dry Matter (%)
TADC	A6	28-4-01	Cucumber	2.10	13.28	525.30	4.32
TADC	A5	23-5-01	Tomato	2.79	14.8	171.8	5.59
TADC	A5	12-6-01	Tomato	3.35	23.1	273.8	5.39
TADC	A5	3-7-01	Tomato	3.15	21.5	225.9	5.39
TADC	A11	12-6-01	Tomato	3.18	17.9	332.3	
TADC	A14	12-6-01	Tomato	3.14	22.0	275.2	
TADC	B2	12-6-01	Tomato	3.42	18.6	296.0	
TADC	A3	20-6-01	Pepper	3.12	125.8	412.6	6.68
TADC	A3	10-7-01	Pepper	3.23	74.1	525.4	
TADC	A3	7-8-01	Pepper	2.96	106.5	339.9	6.25
TADC	A2	20-6-01	Pepper	2.40	60.8	530.8	
TADC	A12	20-6-01	Pepper	2.18	43.2	590.6	
TADC	B1	20-6-01	Pepper	2.78	75.0	442.0	
TADC	B4	20-6-01	Pepper	2.44	57.9	492.8	
TADC	C4	20-6-01	Pepper	2.49	44.6	574.6	
TADC	A4	29-5-01	Andrea Eggplant	2.35	3.6	712.2	4.32
TADC	A4	3-7-01	Andrea Eggplant	2.26	2.4	670.1	5.83
TADC	A4	7-8-01	Andrea Eggplant	2.00	2.0	870.4	7.97
TADC	A4	29-5-01	Longo Eggplant	2.80	5.1	777.7	7.42
TADC	A4	3-7-01	Longo Eggplant	2.25	2.6	682.4	7.71
TADC	A4	7-8-01	Longo Eggplant	1.83	3.0	827.8	7.93
LiuFu	S11	28-4-01	Cucumber	2.27	15.1	598.8	4.88
LiuFu	S11	23-5-01	Cucumber	2.84	18.9	581.1	5.44
LiuFu	S11	29-5-01	Cucumber	2.37	16.2	653.4	5.38
LiuFu	S1	28-4-01	Cucumber	2.37	13.3	561.6	
LiuFu	S5	28-4-01	Cucumber	2.41	13.0	547.0	
LiuFu	S9	28-4-01	Cucumber	2.35	15.0	483.2	
LiuFu	S7	28-4-01	Cucumber	2.25	14.0	470.4	
LiuFu	S3	29-5-01	Tomato	2.55	16.0	233.8	5.95
LiuFu	S3	25-6-01	Tomato	2.85	16.7	213.0	5.67
LiuFu	S3	10-7-01	Tomato	2.77	18.3	297.9	5.51
LiuFu	S0	25-6-01	Tomato	2.69	17.3	238.0	
LiuFu	S4	25-6-01	Tomato	2.88	16.1	169.0	
LiuFu	S10	25-6-01	Tomato	2.56	15.2	216.3	
LiuFu	S12	25-6-01	Tomato	2.5	15.2	192.4	
LiuFu	N3	25-6-01	Tomato	2.36	13.4	184.7	
LiuFu	N7	25-6-01	Cherry To.	4.84	17.8	236.1	
LiuFu	N10	25-6-01	Tomato	2.66	13.9	332.2	
LiuFu	N15	25-6-01	Tomato	2.4	15.7	210.8	

Location	Greenhouse No.	Date (dd-mm-yy)	Crop	Sugar (%)	Vitamin C (mg/100g)	Nitrate (mg/kg)	Dry Matter (%)
LiuFu out	No. 6	27-6-01	Eggplant	2.63	2.7	620.5	7.82
LiuFu out	No. 6	19-7-01	Eggplant	2.42	3.9	531.0	7.81
LiuFu out	No. 16	19-7-01	Eggplant	2.97	3.3	724.3	
LiuFu out	No. 11	27-6-01	Pepper	3.17	93.1	454.8	6.04
LiuFu out	No. 11	1-8-01	Pepper	2.89	35.1	336.5	4.12
LiuFu out	No. 1	19-7-01	Pepper	3	115.3	1571.3	
LiuFu out	No. 4	19-7-01	Pepper	3.86	117.8	630.3	
LiuFu out	No. 9	19-7-01	Pepper	3.71	104.5	511.7	
LiuFu out	No. 12	19-7-01	Pepper	4.08	116.0	579.4	
DangCheng	Line1-10	23-5-01	Cucumber	3.31	17.3	558.8	6.12
DangCheng	Line1-10	29-5-01	Cucumber	2.79	19.3	689.2	8.20
DangCheng	Line1-10	1-8-01	Cucumber	1.57	15.6	431.4	6.19
DangCheng	Line1-4	29-5-01	Cucumber	3.68	17.1	631.6	
DangCheng	Line1-5	29-5-01	Cucumber	2.30	11.7	541.2	
DangCheng	Line1-7	29-5-01	Cucumber	2.78	12.1	826.4	
DangCheng	Line1-12	29-5-01	Cucumber	3.46	19.2	698.9	
DangCheng	Line2-5	25-6-01	Tomato	2.42	39.8	234.0	6.02
DangCheng	Line2-5	10-7-01	Tomato	2.46	18.7	278.7	5.63
DangCheng	Line2-5	19-7-01	Tomato	3.66	24.6	315.1	6.15
DangCheng	Line1-1	10-7-01	Tomato	2.85	21.6	251.0	
DangCheng	Line1-2	10-7-01	Tomato	2.27	13.3	251.8	
DangCheng	Line2-3	10-7-01	Tomato	3.00	16.5	134.0	
DangCheng	Line2-6	10-7-01	Tomato	3.24	21.4	226.0	
DangCheng	Line2-7	10-7-01	Tomato	3.13	18.0	171.1	
DangCheng	Line2-9	10-7-01	Tomato	3.48	20.8	155.8	
DangCheng	Line2-11	10-7-01	Tomato	3.12	17.3	190.1	
DangCheng	Line2-12	10-7-01	Tomato	2.97	18.3	200.1	
DangCheng	Line1-6	27-6-01	Eggplant	2.34	1.4	636.9	6.95
DangCheng	Line1-3	19-7-01	Eggplant	2.85	1.9		
DangCheng	Line1-13	19-7-01	Eggplant	2.14	2.7	855.4	
DangCheng	Line2-1	19-7-01	Eggplant	3.02	1.0	582.4	
DangCheng	Line3-4	19-7-01	Pepper	5.63	116.2	943.9	8.28
DangCheng	Line3-4	27-6-01	Pepper	2.93	77.6	541.7	6.36
DangCheng	Line1-8	19-7-01	Pepper	4.41	114.0	665.0	
DangCheng	Line1-9	1-8-01	Pepper	3.48	29.8	533.5	
DangCheng	Line2-13	19-7-01	Pepper	3.53	61.0	504.8	
DangCheng	Line3-1	19-7-01	Pepper	2.80	68.7	402.0	
DangCheng	Line3-2	19-7-01	Pepper	3.40	77.6	380.2	
DangCheng	Line3-3	19-7-01	Pepper	3.69	74.6	885.9	

Table 5.2. Results of fruit analyses: nutrient uptake (kg/ha) and N-P-K inorganic fertiliser input (*) excluding organic manure for the year 2001.

							kg/ha						
	Greenhouse			Fruit analysis results				N-fruit	N-input	P-fruit	P-input	K-fruit	K-input
Location	No.	Date mm/dd	Plant	N%	P%	K%	Yield	uptake	(*)	uptake	(*)	uptake	(*)
TADC	A6	4-28	Cucumber	2.921	0.969	5.12	49406	62	475	20.7	121	109.3	239
TADC	A5	5-23	Tomato	2.463	0.627	6.02	50058	69		17.5		168.5	
TADC	A5	6-12	Tomato	2.596	0.503	2.57	50058	70		13.6		69.3	
TADC	A5	7-3	Tomato	2.252	0.480	4.18	50058	61	260	13.0	102	112.8	77
TADC	A4	5-29	Eggplant. Ad.	2.260	0.473	3.34	21034	21		4.3		30.3	
TADC	A4	7-3	Eggplant. Ad.	2.506	0.486	3.20	21034	31		6.0		39.2	
TADC	A4	8-7	Eggplant. Ad.	2.152	0.532	3.37	21034	36		8.9		56.5	
TADC	A4	5-29	Eggplant. Lo.	2.625	0.476	3.41	15709	31		5.5		39.7	
TADC	A4	7-3	Eggplant. Lo.	2.175	0.495	3.46	15709	26		6.0		41.9	
TADC	A4	8-7	Eggplant. Lo.	2.587	0.479	3.79	15709	32	395	6.0	119	47.2	181
TADC	A3	6-20	Pepper	2.254	0.495	3.76	23845	36		7.9		59.9	
TADC	A3	8-7	Pepper	2.006	0.491	3.00	23845	30	242	7.3	78	44.7	34
LiuFu	S11	4-28	Cucumber	2.734	0.971	3.26	27837	37		13		44.2	
LiuFu	S11	5-23	Cucumber	3.326	0.740	3.21	27837	50		11		48.6	
LiuFu	S11	5-29	Cucumber	3.612	0.788	2.91	27837	54	742	12	0	43.5	0
LiuFu	S3	5-29	Tomato	2.022	0.469	6.73	63077	76		18		252.7	
LiuFu	S3	6-25	Tomato	1.947	0.375	3.56	63077	70		13		127.3	
LiuFu	S3	7-10	Tomato	2.218	0.323	4.36	63077	77	0	11	0	151.4	0
LiuFu	Out 6	6-27	Eggplant	2.432	0.361	3.60	5430	10		2		15.3	
LiuFu	Out 6	7-19	Eggplant	2.272	0.346	3.02	5430	10	845	1	297	12.8	563
LiuFu	Out 11	6-27	Pepper	2.285	0.385	3.16	825	1		0		1.6	
LiuFu	Out 11	8-1	Pepper	2.028	0.340	2.83	825	1	811	0	384	1.0	540
DC	Line1-10	5-23	Cucumber	2.549	0.504	3.08	38194	60		12		72.0	
DC	Line1-10	5-29	Cucumber	2.472	0.437	3.24	38194	77		14		101.5	
DC	Line1-10	8-1	Cucumber	3.652	0.609	5.87	38194	86	0	14	0	138.8	0
DC	Line2-5	6-25	Tomato	2.118	0.477	5.12	33664	43		10		103.7	
DC	Line2-5	7-10	Tomato	2.157	0.436	3.08	33664	41		8		58.3	
DC	Line2-5	7-19	Tomato	2.023	0.390	2.63	33664	42	26	8	11	54.5	22
DC	Line1-6	6-27	Eggplant	1.979	0.256	3.42	18254	25	227	3	20	43.3	37
DC	Line3-4	6-27	Pepper	2.186	0.394	4.15	6494	9		2		17.1	
DC	Line3-4	7-19	Pepper	2.368	0.478	3.57	6494	13	79	3	0	19.2	0

Table 5.3. Plant residue analyses results and N-P-K plant output in kg/ha (considering 20% DM) for the year 2001.

Location	Greenhouse No.	Date dd/mm	Plant	Crop residue analysis result N%	P%	K%	Crop residue kg/ha	Output crop residue N kg/ha	P kg/ha	K kg/ha
LiuFu	n 11		Pepper	2.390	0.221	3.65	5217	24.9	2.3	38
LiuFu	n 6		Eggplant	1.897	0.122	3.43	3801	14.4	0.9	26
LiuFu	11 south		Cucumber	2.381	0.343	3.93	806	3.8	0.6	6
LiuFu	3 south		Tomato	2.537	0.354	4.99	7875	39.9	5.6	79
DC	n 3-4		Pepper	2.647	0.223	4.62	3910	20.7	1.7	36
DC	no. 1-6		Eggplant	2.445	0.197	6.34	2946	14.4	1.2	37
DC	no. 1-10		Cucumber	2.134	0.240	3.51	2917	12.4	1.4	20
DC	no. 2-5		Tomato	1.521	0.250	3.20	5865	17.8	2.9	38
TADC	A5	23-5	Tomato	3.627	0.635	4.76	4697	34.1	6.0	45
TADC	A5	3-7	Tomato	3.709	0.570	4.43	4697	34.8	5.4	42
TADC	A5	7-7	Tomato	2.000	0.644	5.43	4697	18.8	6.0	51
TADC	A5	8-7	Tomato	1.836	0.190	3.41	4697	17.2	1.8	32
TADC	A4	29-5	Eggplant Andrea	4.224	0.337	5.17	5419	45.8	3.7	56
TADC	A4	3-7	Eggplant Andrea	3.812	0.447	2.18	5419	41.3	4.8	24
TADC	A4	29-5	Eggplant Longo	4.482	0.555	4.14	7542	67.6	8.4	62
TADC	A4	7-7	Eggplant Longo	3.988	0.342	5.43	7542	60.2	5.2	82
TADC	A3	23-8	Pepper	2.798	0.334	2.05	3430	19.2	2.3	14

Table 5.4. Results on products analyses and plant residue analyses at TADC for the year 2002.

Greenhouse No.	Variety	Fruit NO_3 (mg/kg fresh base)	Fruit N% dry base	Fruit DM %	Plant residues N% Mid-stage		Harvest	
A2	Deltastar	292	3.8	3.57	May	3.2	16-jul	2.1
A2	Jinyou10	861	3.2	4.92	June	2.6	10-jul	2.2
A3	Deltastar	383	3.5	3.66	June	2.5	24-jul	2.8
A3	Jinyou10	384	3.4	3.92	May	3.2	16-jul	2.6
A4	Deltastar	300	3.9	3.94	June	2.9	16-jul	2.9
A4	Jinyou10	604	4.1	3.78	June	2.8	16-jul	3.0
A11	Deltastar	497	3.6	4.66	June	3.1	13-jul	2.8
A11	Jinyou10	359	3.7	3.94	May	3.0	10-jul	3.0
A14	Deltastar	635	3.7	5.31	June	3.2	29-jun	2.7
A14	Muge	618	4.4	4.24	May	3.6	29-jun	3.0
A14	126	338	3.1	4.75	May	3.4	29-may	3.2
A14	90	652	3.5	5.07	May	2.9	29-jun	2.6