

# Establishing An All-Year Cropping System in Protected Cultivation

Shyh-Shyan Wang and Shan-Ney Huang

Tainan District Agricultural Research  
and Extension Station

Council of Agriculture, Executive Yuan

# Why we need greenhouse?

## ■ Typhoon

27.4 Typhoons generated from west Pacific Ocean per year and 3.4 attacked Taiwan

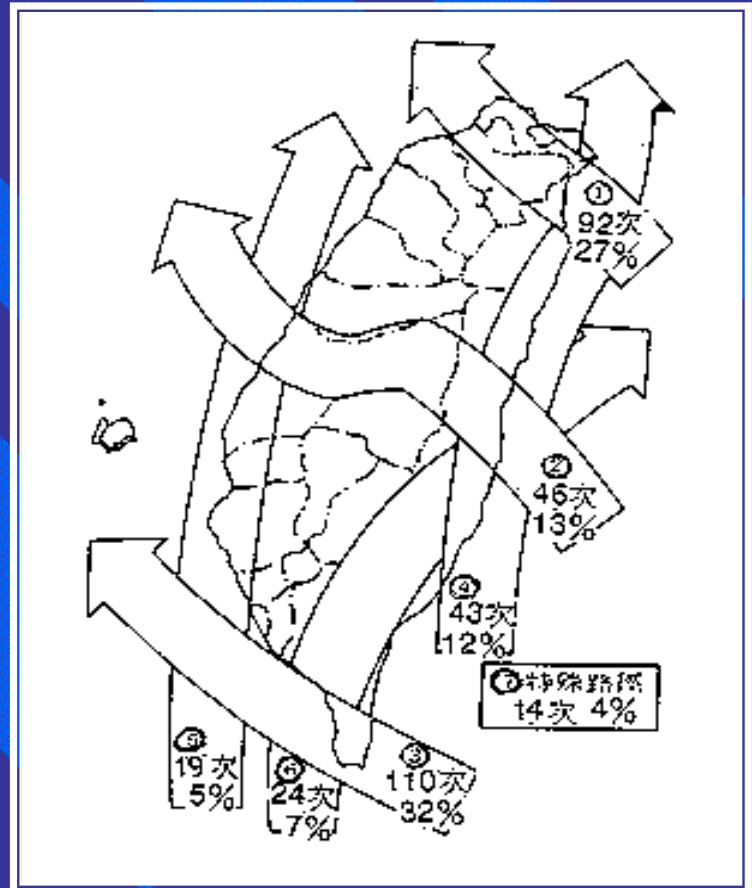
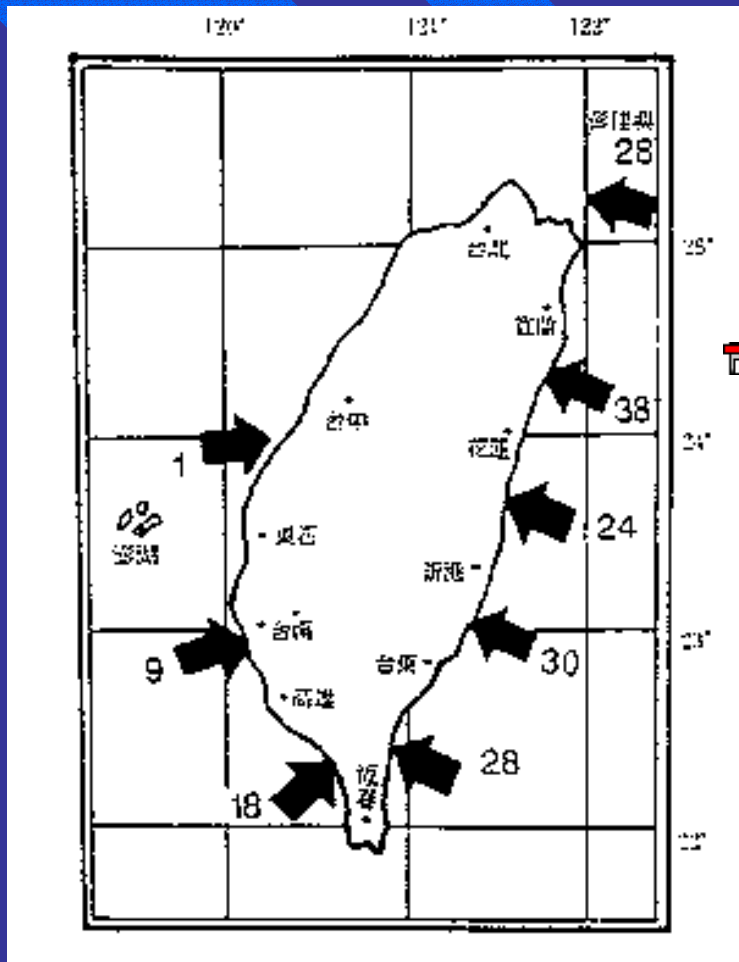
## ■ Heavy Rain

precipitation > 130mm Total Precipitation: 2500mm

May to September are raining season

Raining days 112 days

# Typhoon path and frequency in Taiwan



# (Hu-wei) 虎尾 Tiger tail

- A story about the extension of protected horticulture in southern Taiwan
- From sugarcane to peanut and garlic
- First grow Gladiolus and Tuberosa
- From open field to protected horticulture

# What is “Summer Vegetable / Winter Flower” (SVWF) Cropping System ?

- Grow summer vegetables to get profit from weather-induced period of short supplies. Sometime growers may benefit from an extraordinarily high price.
- Grow spray mum in the winter to avoid over-production and can be exported to Japan market with high international competitiveness.
- To build a year-round production plan.

# Techniques transfer from “Summer Vegetable / Winter Flower” (SVWF)

- Winter flower production –Taiwan Flower Biotechnology (TFB) com.
- Summer tomato production-Tainan DARES
- Greenhouse management-TFB &Tainan DARES
- Drip irrigation -TFB &Tainan DARES & Netafim company

# Chrysanthemum In Taiwan

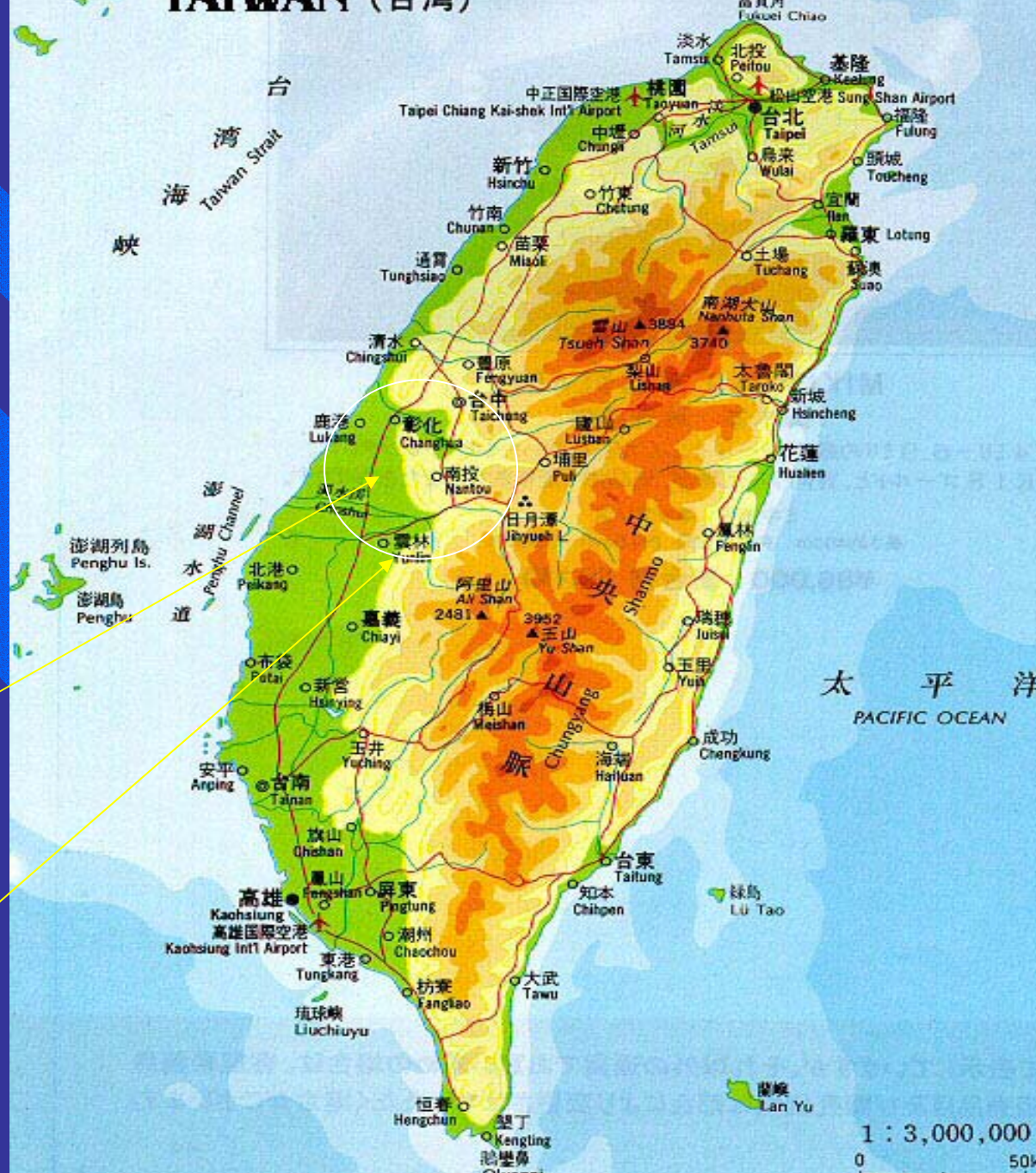
Planting area: 1514ha

Total produce in 2000

: 369,000,000 unit.

Traditional plant  
area: **Changhua**

New Spray Mum  
under Protected  
plant area: **Yunlin**



**Traditional  
Standard  
Mum  
Produced  
in Taiwan**



Open field Tien-Wei(田尾)



**New type of  
spray mums  
are grown  
under  
protected  
structure**



**Left :**

**Stem Size Are  
not Uniform  
From the  
Conventional  
Method**

**Right :**

**New Method  
Has Uniform  
Stem  
Diameter**



**Left :**

**Darker Flower  
Color and Big  
Center In the  
Open Field**

**Right :**

**Flower Color  
and Small  
Center Under  
Protected Field**



**Spray Mum in  
Protected Field  
Are Once-  
Harvested and  
Prevented The  
Flowers from  
Soil Infection**



**Harvested  
Mums must  
be sorted into  
various  
grades within  
2 hours to  
keep cut  
flower quality**



# Precooling to keep the quality of Spray Mum



**Transport  
by a  
cooling  
container  
car.**



# First step of (SVWF) Cropping System

Month											
四	五	六	七	八	九	十	十一	十二	一	二	三
A	M	J	J	A	S	O	N	D	J	F	M
Tomato & Cucumber				Corn	Spray mums & Eustoma						





# Targets of TFB

- Four Crops of spray mums per year
- Reduce the fumigation rate from 95% to 10-15% which will improve the cut-flower quality and cut down the cost of fumigation when exported to Japan market.

# High density spray mums production

- Greenhouse chrysanthemum production using single stem with high density had developed in Ohio state in 1946.
- TFB introduced this system from Israel.







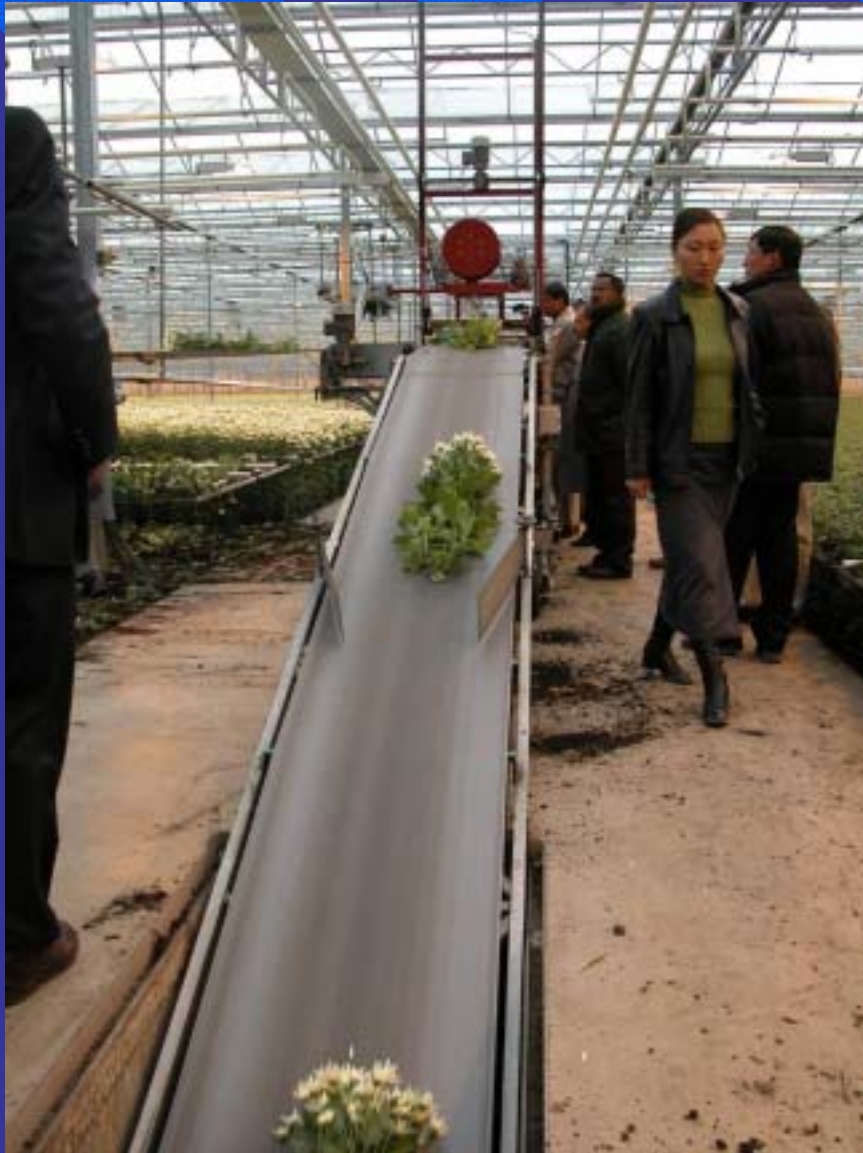




















# Fumigation rate of exported spray mums in 2000 and 2001.

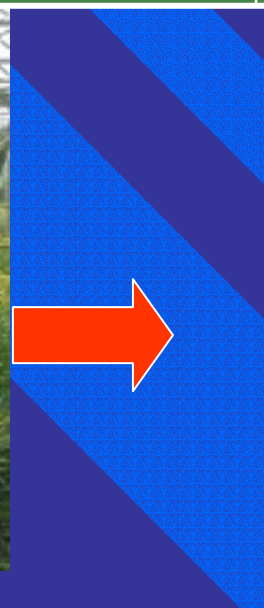
Year	Month	Export amount (Cargo no.)	Fumigation (Cargo no.)	Fumigation rate( % )
2000	11-12	6	4	67
	1-3	7	3	43
2001	11-12	6	3	50
	1-3	22	2	9

There are 82,000 cut flower in a cargo.

(From TEB)

# Development of greenhouse area and quantity of exported pray mums from 1999 to 2004 in Hu-Wei Farmers Association

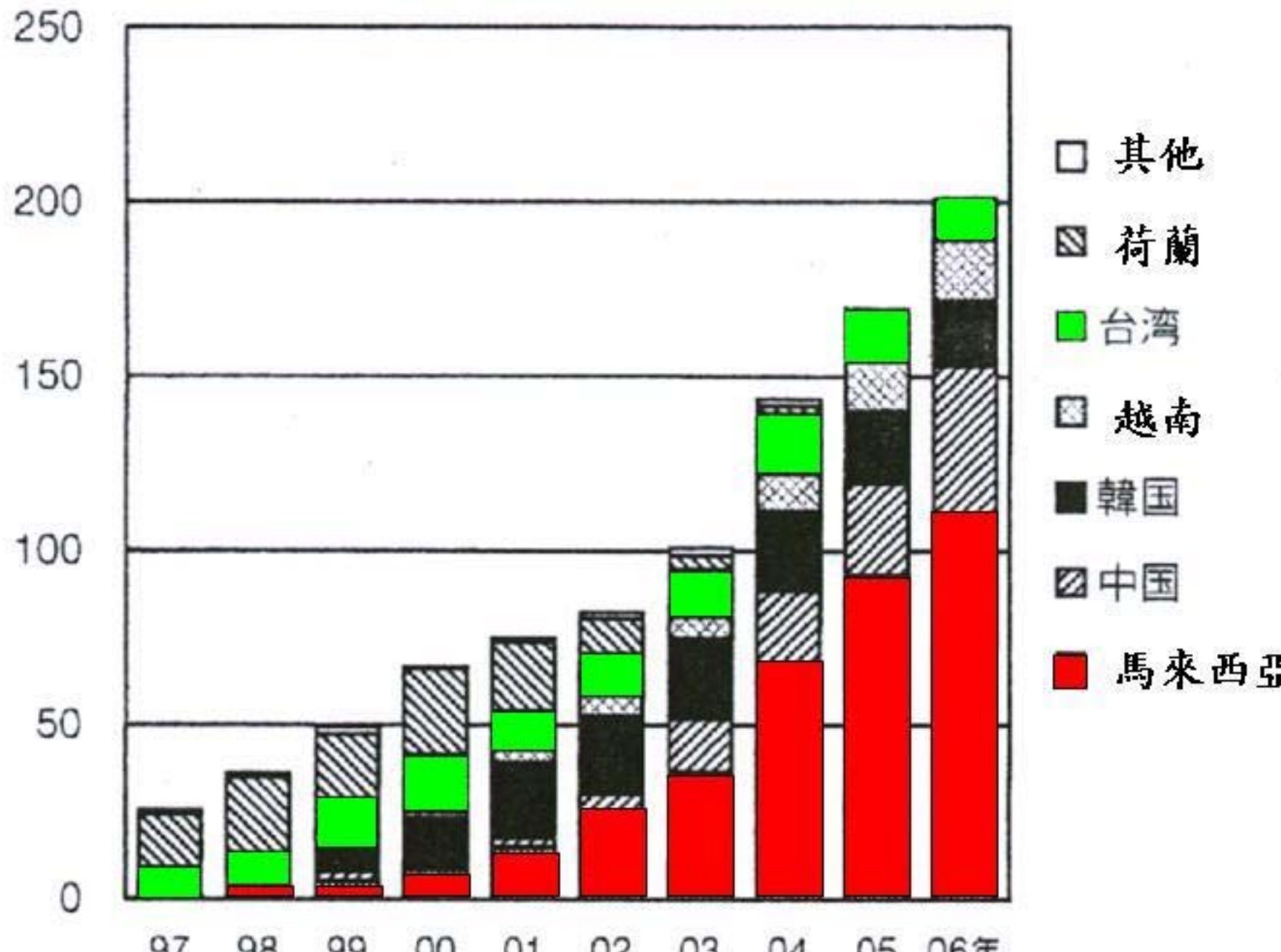
	1999	2000	2001	2002	2003	2004
GH Area (ha)	0.2	2	4	8	10	12
Export	Trial	780000	1360000	3250000	4850000	3850000



COA	DARES BAPHIO	University	Farmers Ass	Farme rs	Agro- business
-----	-----------------	------------	----------------	-------------	-------------------



キクの輸入量推移(単位 百万本)





8/25/2001



3/14/2001

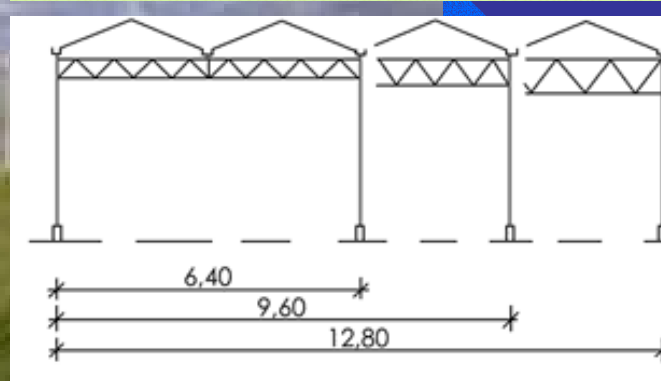
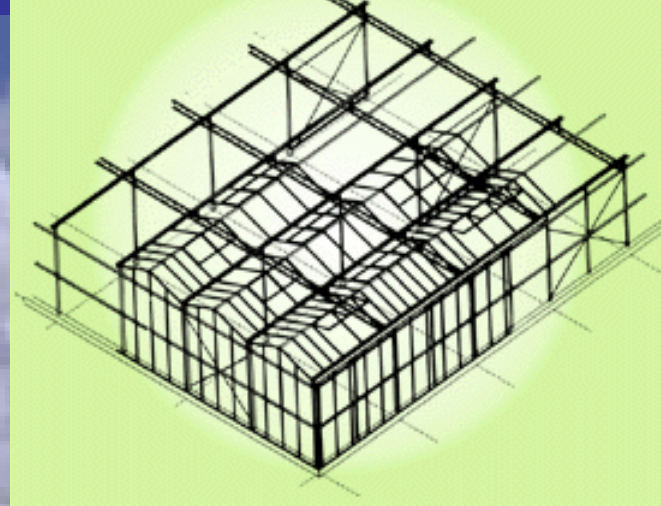


# 外銷花卉集貨場



# Greenhouse Development in Taiwan

- Protected agriculture is a wide category of production methods providing some degree of control over various environmental factors.
- From Simple (low-technology) to medium-technology greenhouse.



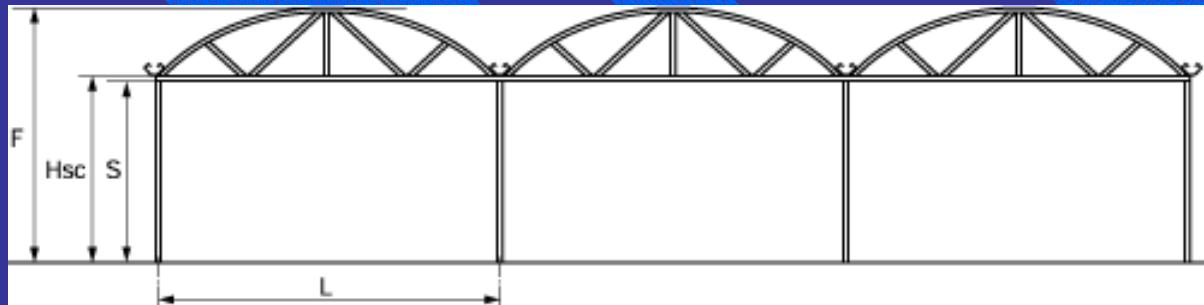
## A. Venlo Type Greenhouse :

High-technology greenhouse with active environmental control



A. Venlo type greenhouse :





3. Venlo-like greenhouse :

Medium-technology greenhouse with limited or passive environmental control.



C. Simple galvanized steel with T type  
reinforce structure Greenhouse :



**D. Simple galvanizing steel greenhouse**



E. Shade house or net house



F. Shading net

# Types of Protected structure in Taiwan:

O: With      : Option  
X: Without

Type	Venlo	Venlo-like	Simple Galvanizing steel with T	Simple Galvanizing steel	Shade house	Shading net
Characters						
RC Foundation	O	O	X	X	X	X
2"galvanizing steel structure	O	O	X	X	X	X
Air-tight ability	O	O	O	X	X	X
Rain shelter	O	O	O	O	X	X
Insect	O	O	O		O	X



Venlo-like greenhouse



**Simple galvanizing steel with a  
reverse T type enforce structure  
Greenhouse**



The image shows the interior of a large, modern greenhouse. The structure is supported by a metal frame with vertical posts. The roof is covered with a translucent material, and numerous bright, warm-toned lights are suspended from the ceiling, creating a starburst effect. The floor is covered with rows of plants, likely seedlings, arranged in neat, parallel lines. The overall atmosphere is bright and controlled, typical of a high-tech agricultural facility.

Most advanced greenhouse in  
Tien-Wei Area

# Cost and profits from growing rice and SVWF

Rice  $120,000(\text{income}) - 78,000(\text{cost}) = 42,000\text{NTD}$

2 crops of rice  $42000 * 2 = \mathbf{84,000(\text{NTD/ha})}$

SVWF(2 crops of spray mums and one crop of tomato)

$30,000 * 80\% * 3.9\text{NT} = 1,653,600\text{NTD}(\text{income})$

Cost  $1,638,000(1\text{st}) + 888,000(2\text{nd}) = 2,526,000\text{NTD}$

Profit from spray mums  $1,653,600 * 2 - 2,526,000 = \mathbf{781,200\text{NTD}}$

Cherry tomato  $40,000\text{KG} * 38\text{NT} = 1,520,000\text{NTD}(\text{income})$

Cost of cherry tomato  $616,000\text{NTD}$

Profit from cherry tomato  $1,520,000 - 616,000 = \mathbf{904,000\text{NTD}}$

**Total profit from SVWF  $1,685,200\text{NTD}$**

# Key factors

- Right Place –New production Area
- Right People – Farmers, FA, TFB, Netafim  
COA etc.
- Right Time- very good price for the summer  
cherry tomato.

# Techniques transfer from “Summer Vegetable / Winter Flower” (SVWF)

- Winter flower production –Taiwan Flower Biotechnology (TFB) com.
- Summer tomato production-Tainan DARES
- Greenhouse management-TFB &Tainan DARES
- Drip irrigation -TFB &Tainan DARES & Netafim company

# Summer tomato production- Tainan DARES

- From easy to difficult season.
- It is more easy to grow cherry tomato in March than in April, but when you grow in April, you may get more money because the price is very high.
- Since those farmers never grow cherry tomato and apply plant growth regulator to improve fruit setting in the mid-summer, Mr.Tsai is my middle man to teach farmers



4/13/2001



4/13/2001



Virus infection or  
damage by  
fertilizer ?

4/13/2001





4/13/2001

# Summer Cucumber Production





8/2/2002

A photograph of a beef tomato growing on a vine in a garden. The tomato is large and has a yellow-to-orange gradient. The vine is green and supported by a white trellis. The background is filled with other green foliage.

Next year someone get cocky to  
grow beef tomato in the summer

8/21/2002

# Techniques transfer from “Summer Vegetable / Winter Flower” (SVWF)

- Winter flower production –Taiwan Flower Biotechnology (TFB) com.
- Summer tomato production-Tainan DARES
- Greenhouse management-TFB &Tainan DARES
- Drip irrigation -TFB &Tainan DARES & Netafim company



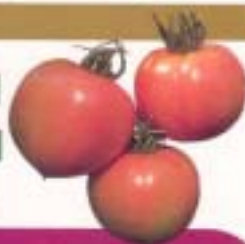
Overdose fertilizer in Open field chrysanthemum



# 野菜・花卉の

ドリップ・ファティゲーション

# 養液土耕



リアルタイム診断と  
点滴灌水・施肥で高品質安定生産

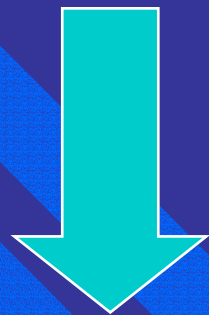
六本木和夫・加藤俊博=著



# Water treatment for drip irrigation



Sand filter



Disk Filter



Overhead sprinkler



Drip irrigation



# Fertigation System





Netafim expert

菊花設施栽培成果觀摩發表會

大 禮

9/3/2002

花

發表會



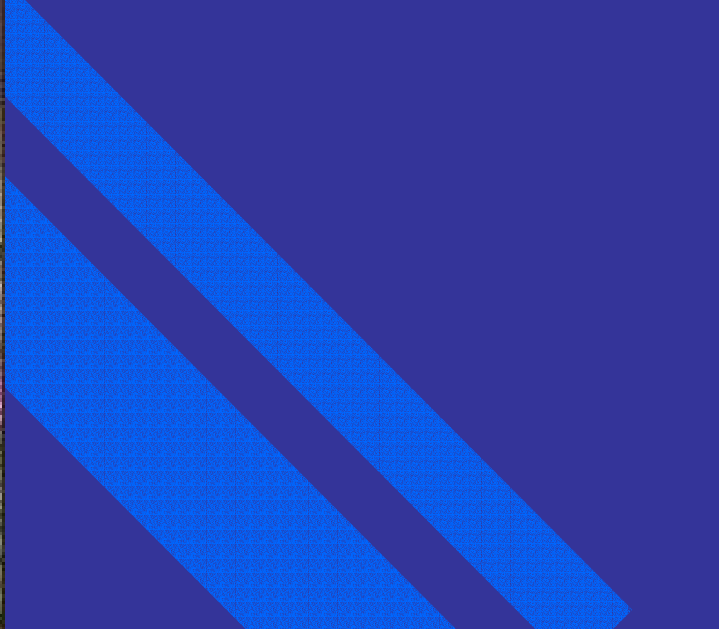
9/3/2002

**Field Day  
for Spray  
Mum  
production**















*Thank you for  
your attention*

# 品牌塑造

德國500大優良品牌的成功經驗

Hidden Champions

Lessons from 500 of  
the World's Best  
Unknown Companies

赫曼·西蒙 著

林添貴 譯



# 競爭優勢的持久性與起源示意圖

競爭優勢的起源



From: Hidden Champions 1996  
Hermann Simon