Greenhouse Construction and Equipment

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1 Introduce myself and our Institute

Introduce myself

- **Dr. Qichang Yang, Professor, Director of Center of Protected Agriculture & Environmental Engineering, IEDA, CAAS**
- **Research field : Protected agriculture and environment engineering**
- **Recent Projects:**

  1.The simulation model of environment and the structure optimization for Chinese solar greenhouse

  2.New saving- energy engineering in greenhouse

  3.Plant factory and hydroponics system

  4.LED light system in plant factory

Our institute: Institute of Environment and Sustainable Development in Agriculture (IEDA) , one of the 39 institutes in CAAS

7 Departments (Centers) in our Institute:

1) Protected Agriculture &Environmental Engineering

2) Climate Change

3) Water Environment

4) Agricultural Ecology

5) Soil Environment

6) Agricultural Meteorology

7) bio-safety

156 staffs : 25 professors,45 associate professors

105 students : graduate students (Master& Ph.D),10 foreign students.

http://www.ieda.org.cn

Center for Protected Agriculture &Environmental Engineering

Group 1: Greenhouse Engineering

Group 2: Greenhouse Climate Control

Group 3: Hydroponics

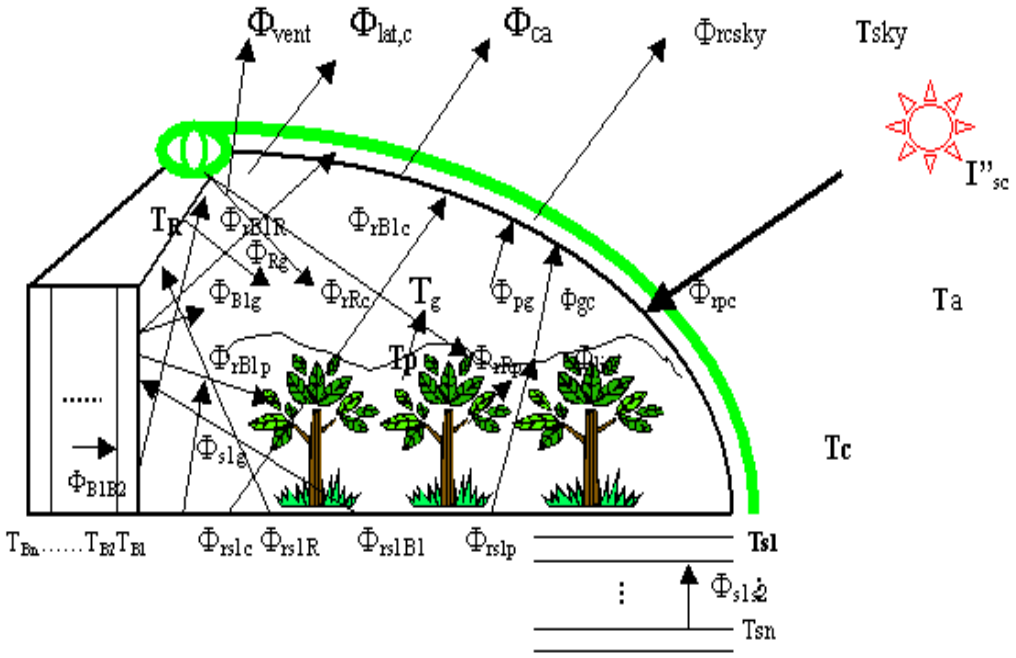
Group 4: Animal Environmental Engineering

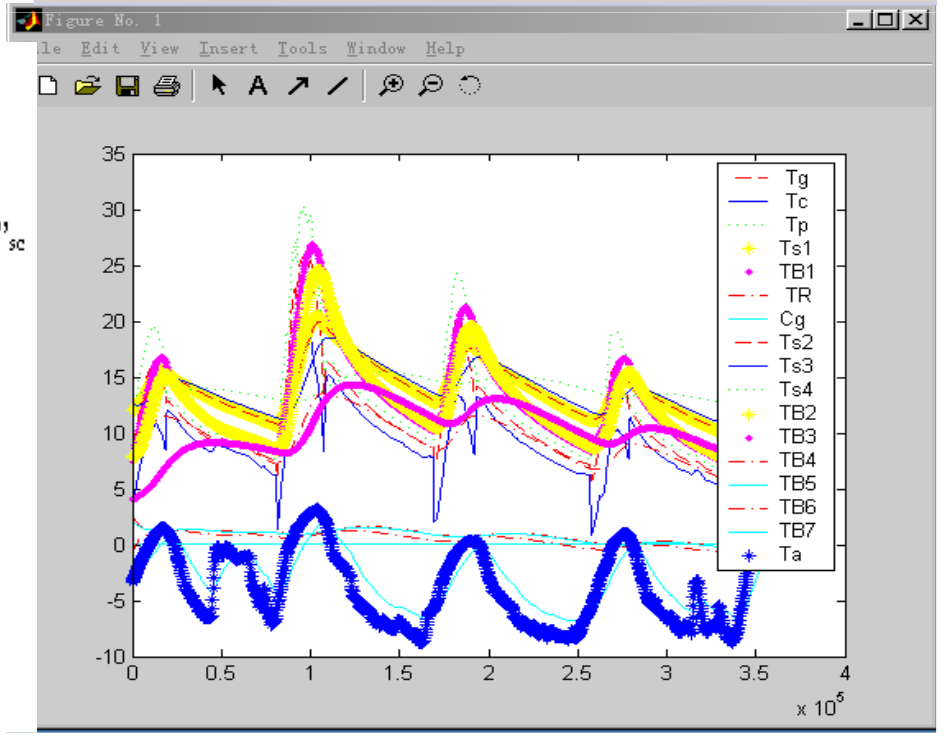
Group 5: Bio-physical Engineering

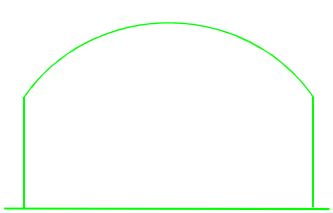
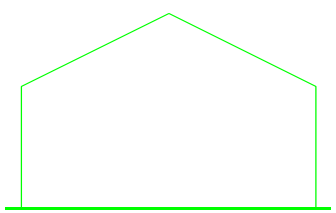
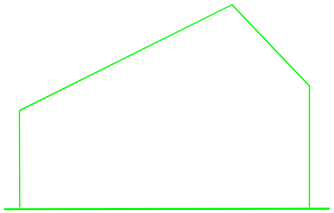
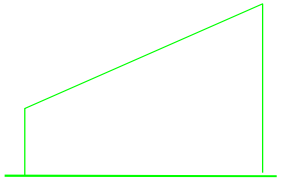
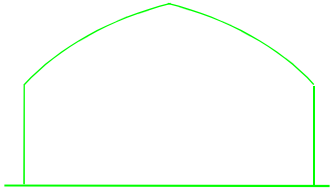
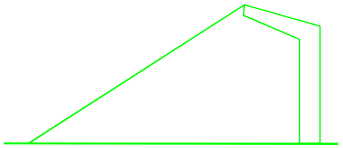
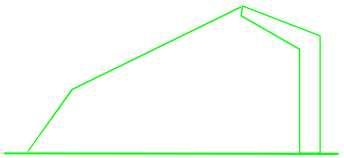
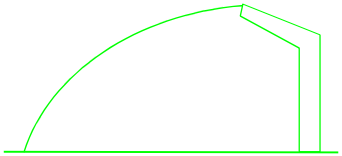
23 staffs : 5 professors, 7 associate professors

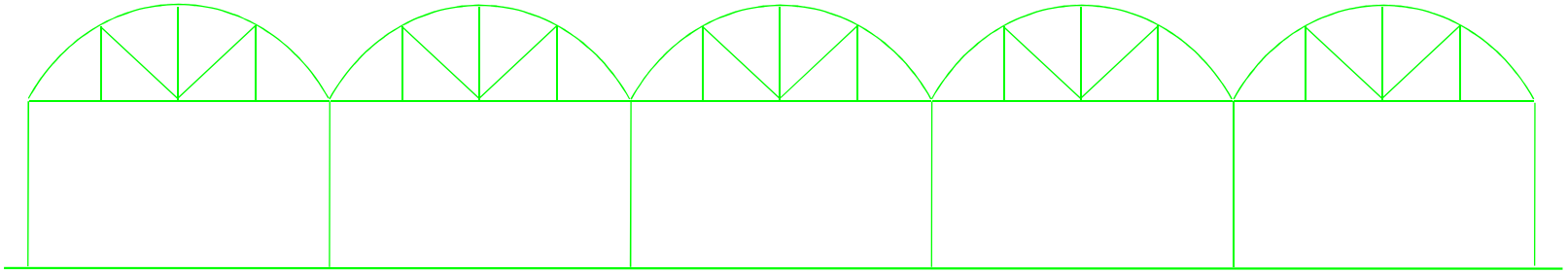
28 graduate students (Master & Ph.D)

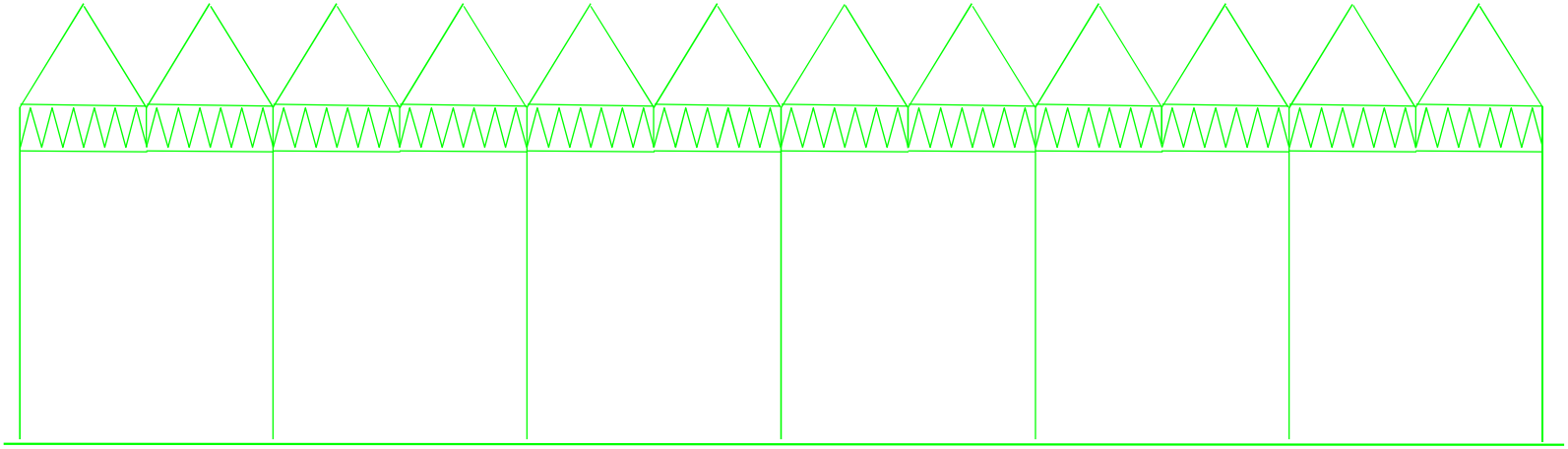
1 Greenhouse Engineering (Modelling, Design, Saving-energy)

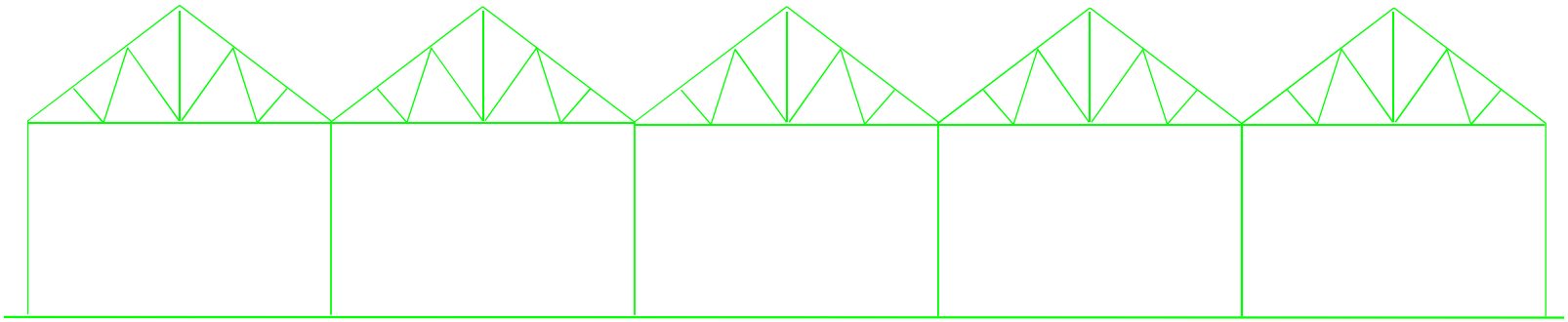


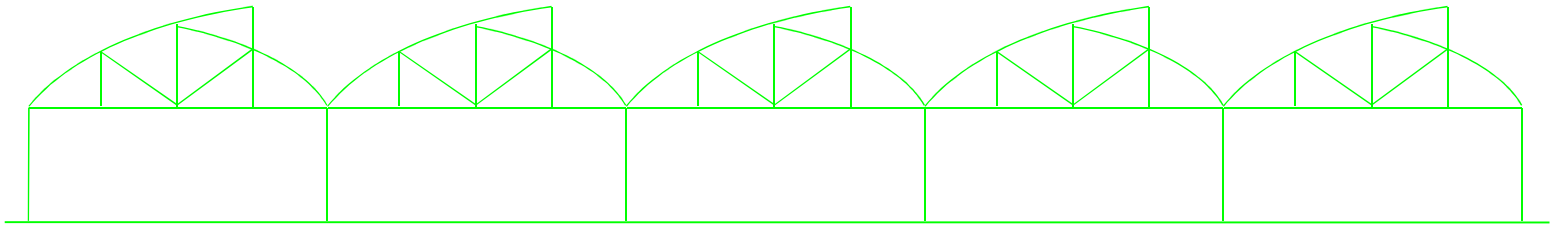


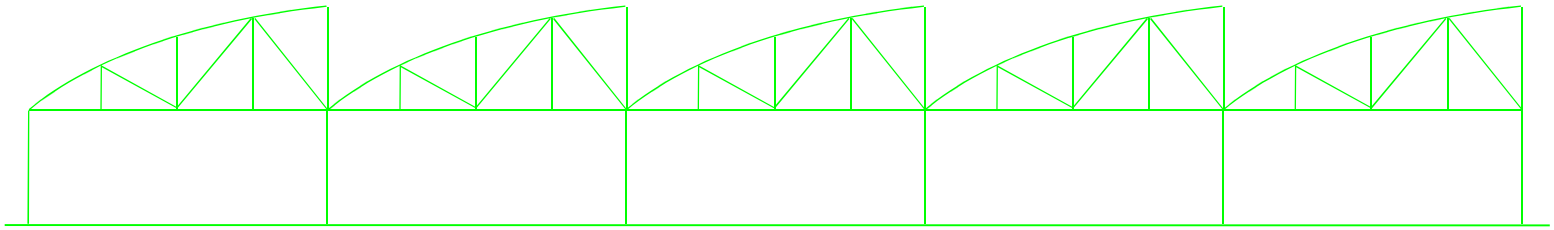



















2 Greenhouse Climate Control based on Internet

Environmental control system

Inputs:

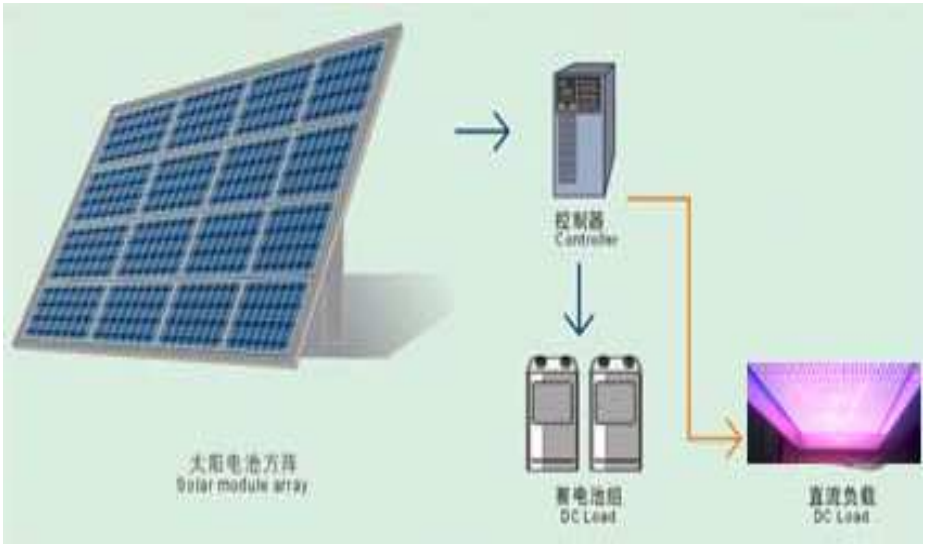
- Temperature
- Humidity
- Wind speed
- wind direction
- Sun radiation
- CO2
- pH
- EC
- Rain
- Water quantity
- Fertilizer qty.

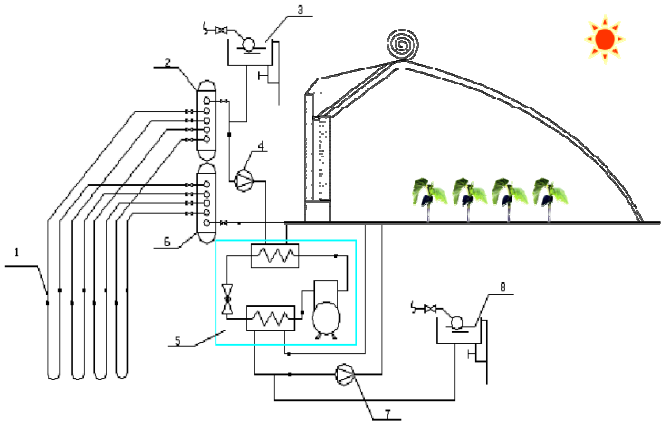
DATA Processing

Outputs:

- Valves
- Fert. Pumps
- Water pumps
- Filters
- Windows
- Fans
- Screens
- Motors
- Foggers
- Heaters
- CO2
- Sprayers
- Humidifiers

3 Saving-energy (LED) and new energy (ground source heat pump, Solar power) in greenhouse





Application of LED Tube in Tissue Culture

T5 or T8 LED Light Tubes

Test of cucumber seedlings with LED

sowing

sprouting

first true leaves

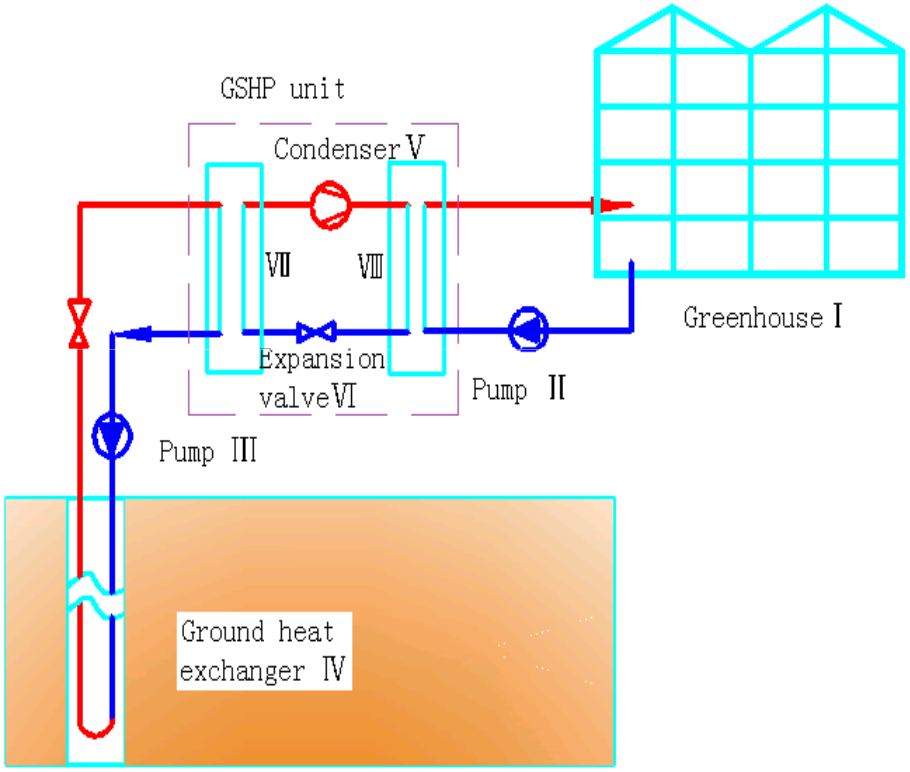
harvest

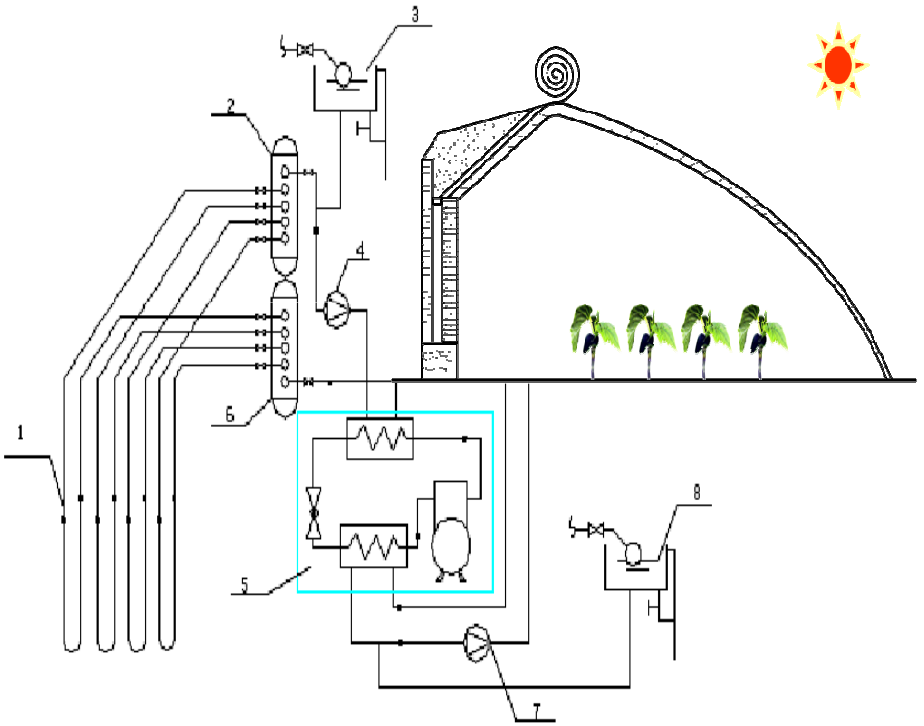
R & D of LED Light Source and Plant Seedling Factory

Application of LED in Leaf Vegetable cultivation

Application of LED Light in Vegetable cultivation

Heat pump system in greenhouses



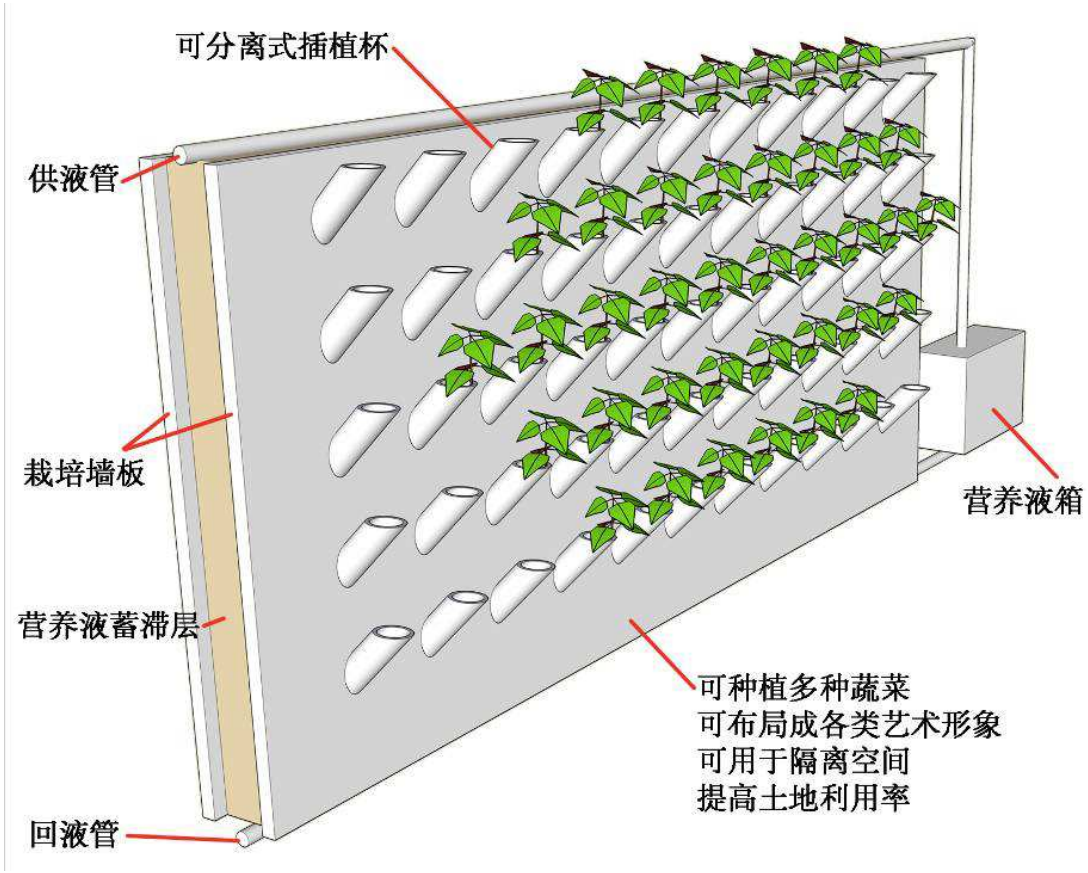


4 Research on Plant factory

Plant factory with artificial light

5 Research on Hydroponics

Wall cultivation




Wall cultivation

Column cultivation


Column cultivation


Over-ground tuber production
of sweet potato
Tuberous roots

Tuberous roots

Nutrient feeding roots

2 Development of greenhouse technologies in China

Main types of greenhouse structures in China

Plastic tunnel

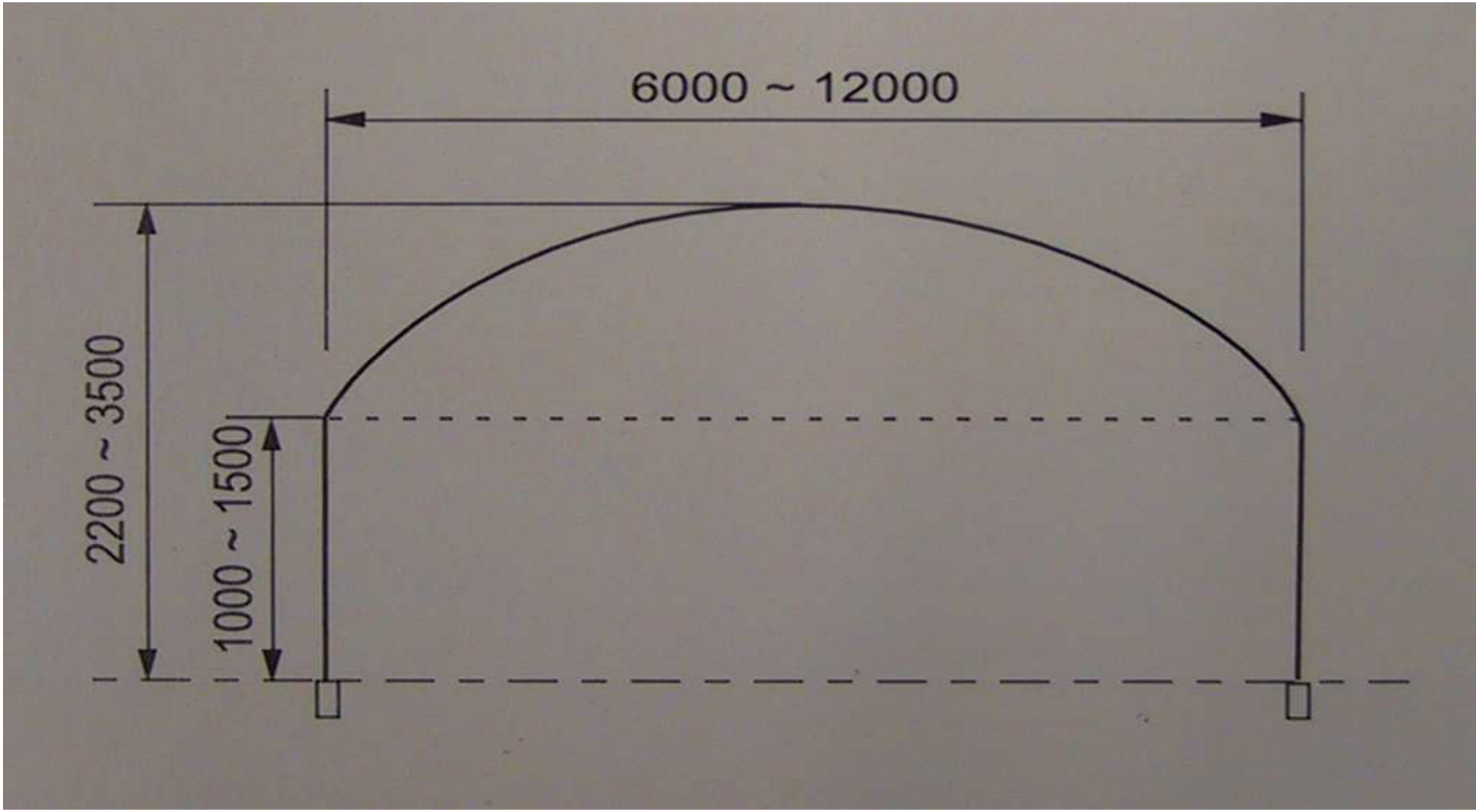
&awning

Chinese Solar greenhouse

Multi-span greenhouse

The types and areas of greenhouse in China

Total Areas (ha)	Chinese Solar greenhouse (ha)	Plastic Tunnel (include small tunnel & Awning) (ha)	Multi-span greenhouse (ha)
3,460,000	1,250,000	2,200,000	10,000
100%	20.23%	78.46%	0.29%



Large plastic tunnel

Height: 2.2~3.5m Width: 6~12m Length: 30~60m


plastic tunnel
(Small one 700,000
Large one 1,500,000)

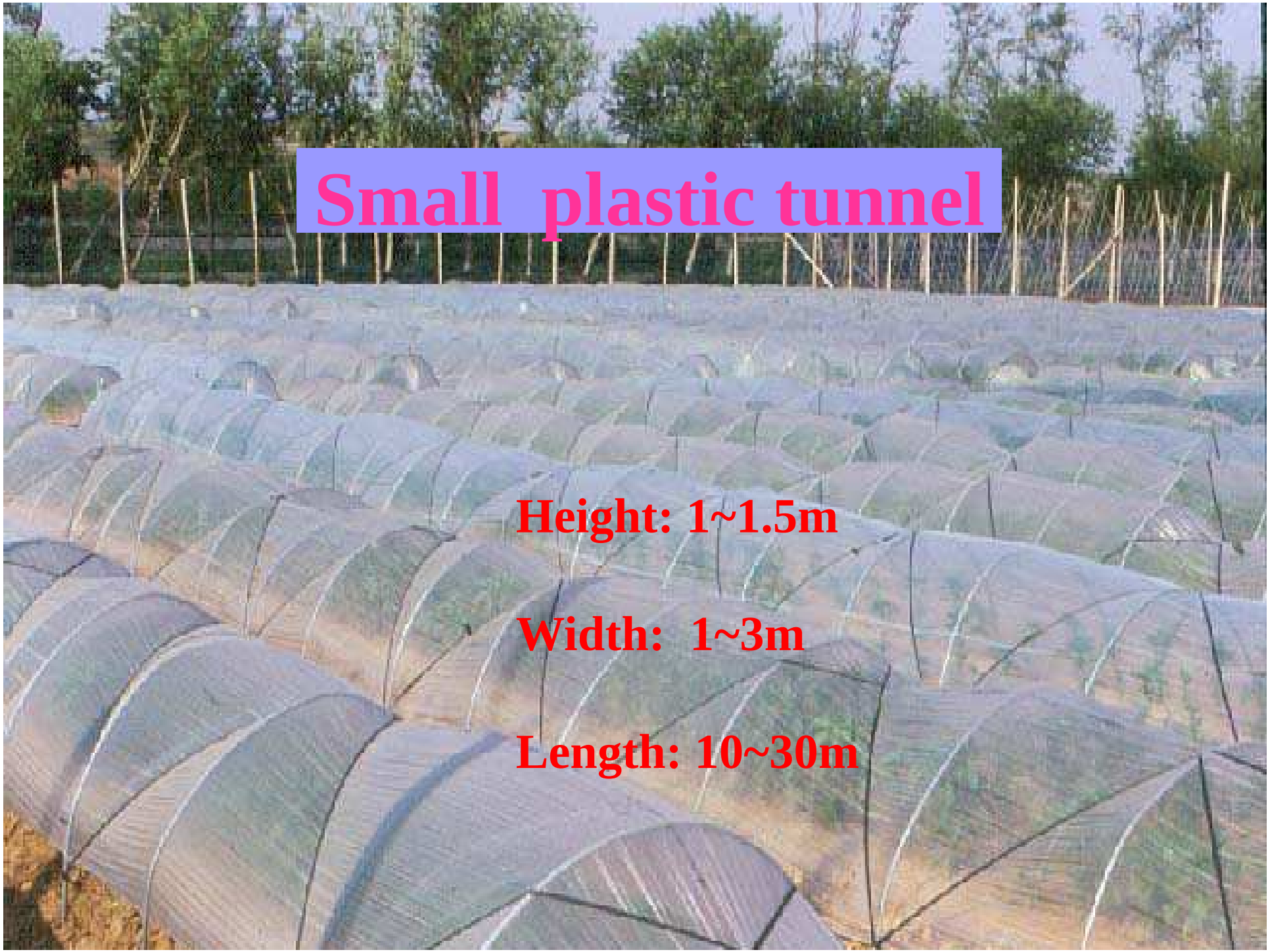

Lettuce in plastic tunnel


Strawberry


Watermelon


Tomato
2002 6 2

Multi-span plastic tunnel


Small plastic tunnel
Height: 1~1.5m
Width: 1~3m
Length: 10~30m


Small plastic tunnel cultivation

Chinese solar greenhouse（1，250，000ha）

Structure and dimension of the Chinese solar greenhouse:

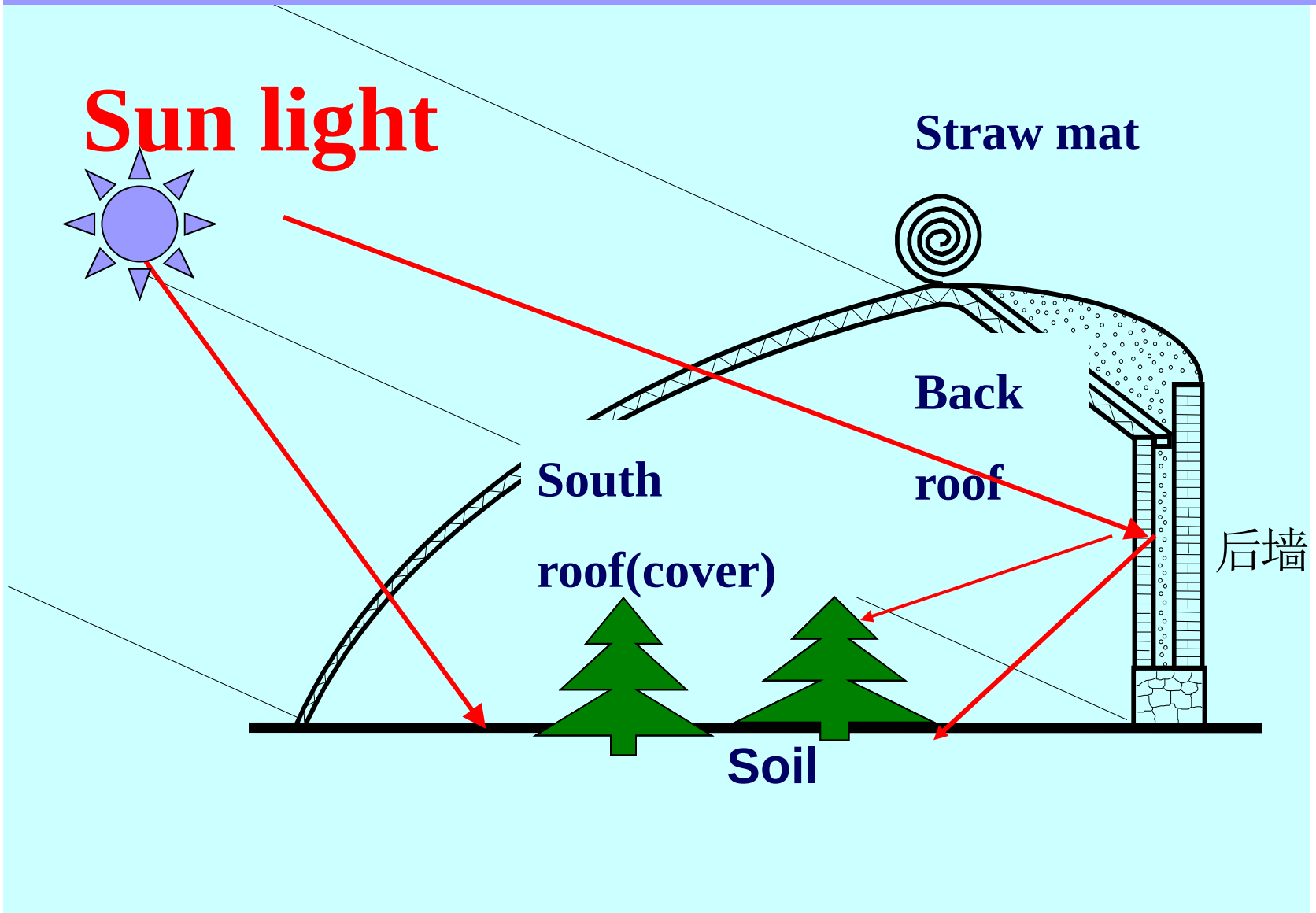
Span (wideth): 6.0-9.0 m

Length: 40-120 m

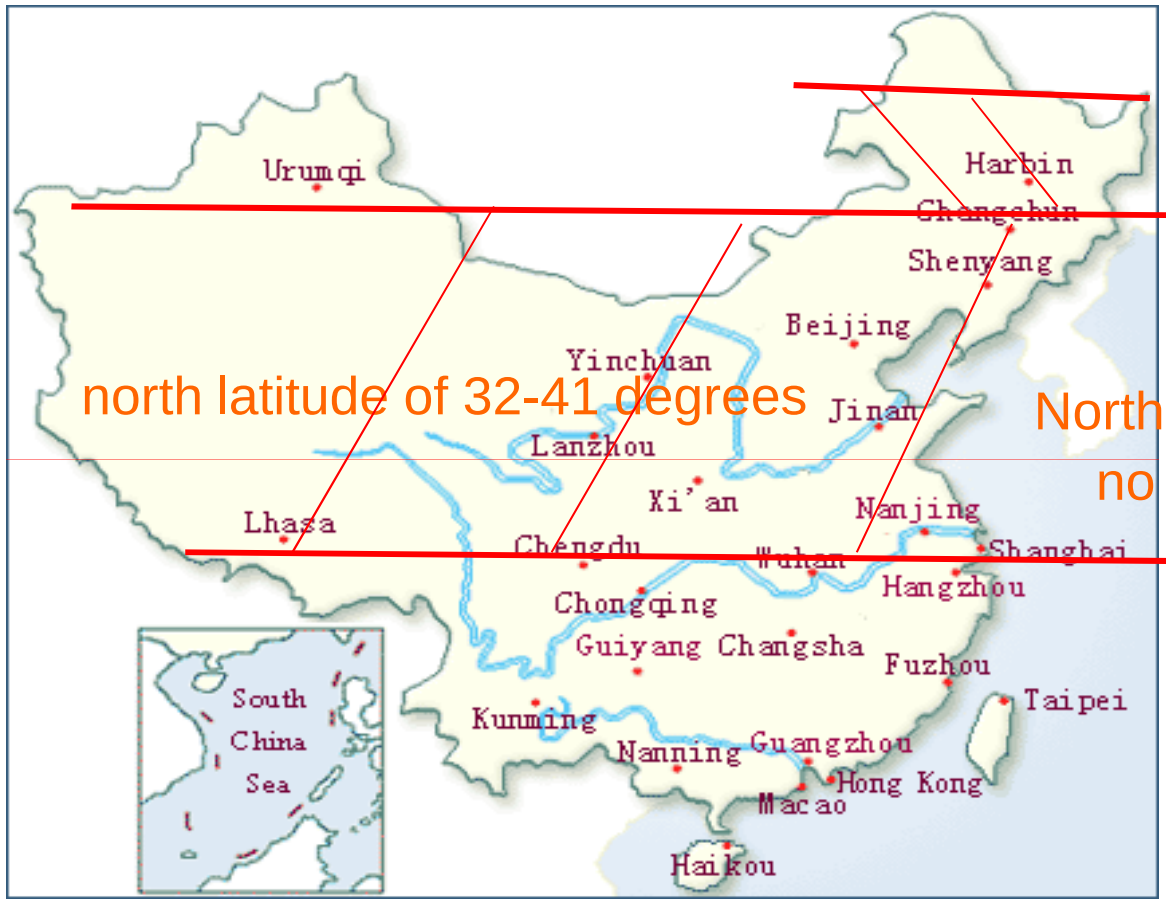
Height: 2.8-3.5 m

North wall thickness: 0.6-1.5m

Principles of the heat reservation in the CSG



Main areas suitable for the CSG



North latitude of 42-48 degrees, partly supplemental heating needed only in the extreme weather

north latitude of 32-41 degrees

North latitude of 32-41 degrees, no heating system needed

Chinese Solar greenhouse

Crops in the CSG (Vegetable, flower, fruit,…)


Flower


Apricot


Nectarine