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CHINA TOBACCO

A study and application of biological control technique of parasitic natural enemy *Aphidius gifuensis* (Hymenoptera: Braconidae) to control *Myzus persicae* (Homoptera: Aphididae) as in China

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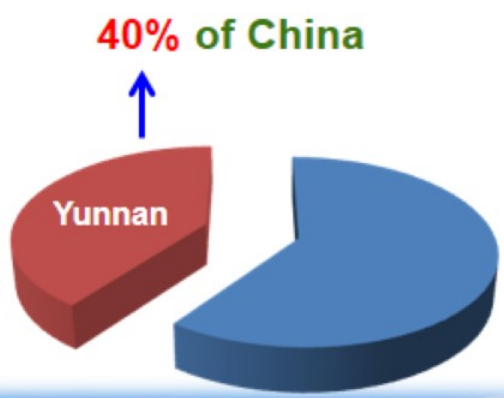
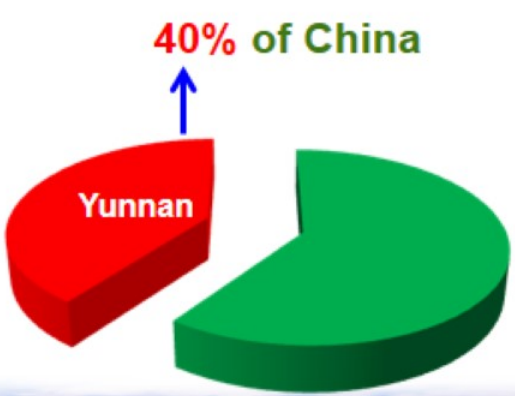
Tobacco production in Yunnan

As one of the most important tobacco growing regions in the world, Yunnan has received worldwide reputation not only for its super-scale tobacco production but also excellent internal qualities of tobacco.

Tobacco leaf yield of the world

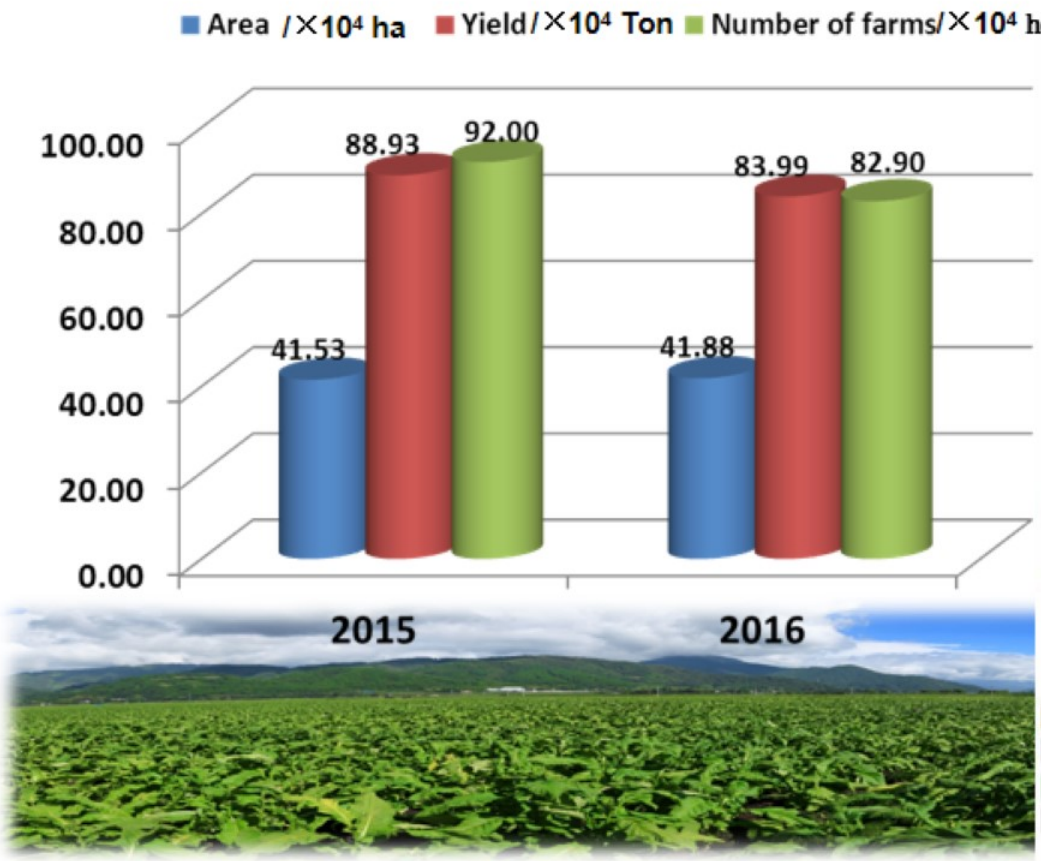


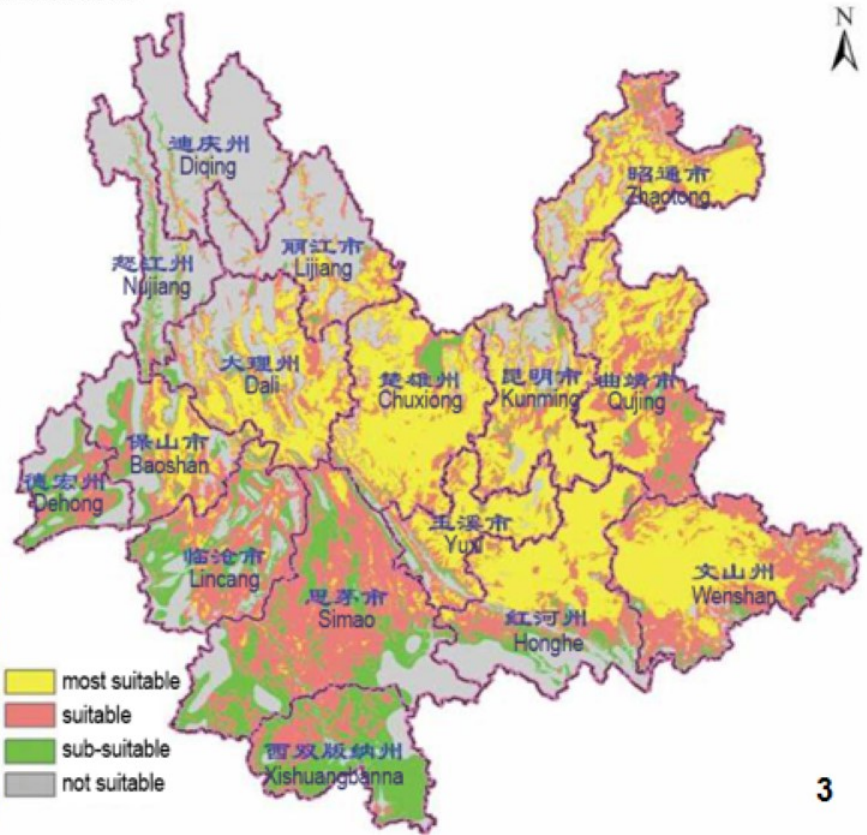
Tobacco leaf yield of China



Tobacco leaf export of China

Tobacco production in Yunnan





The distribution of tobacco production in Yunnan

——Tobacco planting region in Yuxi

The distribution of tobacco production in Yunnan

——Tobacco planting region in Qujing

The distribution of tobacco production inYunnan

——Tobacco planting region in Baoshan

The distribution of tobacco production in Yunnan

——Tobacco planting region in Wenshan

The distribution of tobacco production in Yunnan

——Tobacco planting region in Honghe

The characteristics of Yunnan tobacco cultivation

- Wide distribution of tobacco planting
- Stereoscopic climate and environment
- Smallholder farmers dominate the tobacco production landscape
- Different backgrounds for growers
- Many factors and constraints interact to tobacco leaf yields and quality

How to properly transmit the technology and applied science to the growers and field technicians in the tobacco production chain to produce tobacco leaf with the desired quality and yield able to meet the expectations of the tobacco industry and the growers?

A case of Yunnan experience in dissemination of biocontrol technology to farmers and field technicians

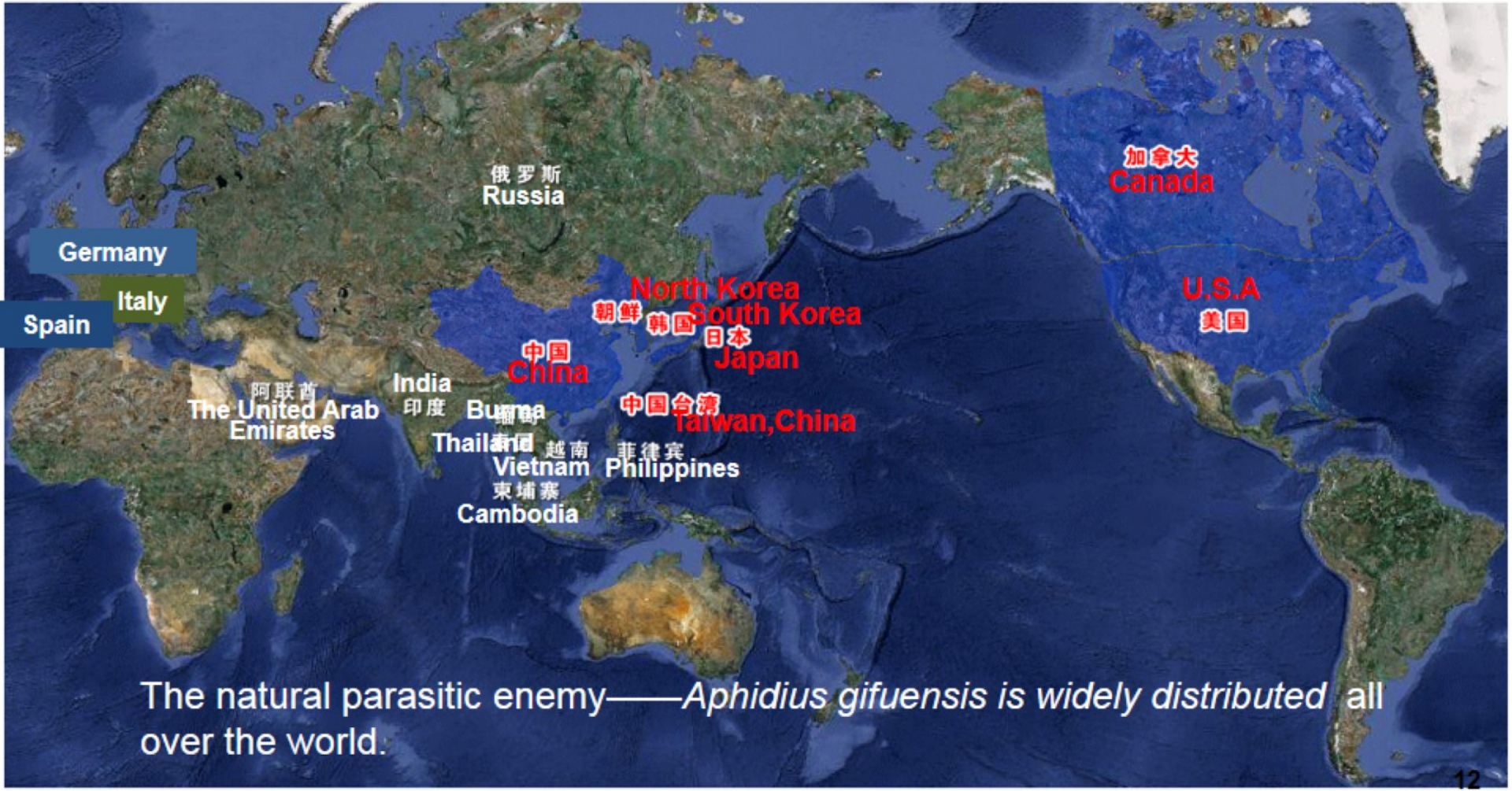
Biological control for *Myzus persicae* with natural enemy --- *Aphidius gifuensis*

The aphid is one of the main pests in agricultural production system including tobacco

Directly

Indirectly

The aphid can not only reduce the quality of tobacco, but also vector viruses such as cucumber mosaic virus and many different potyviruses.



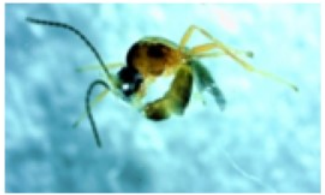
The natural parasitic enemy——*Aphidius gifuensis is widely distributed* all over the world.

The principle of *Myzus persicae* biological control technology with its natural enemy



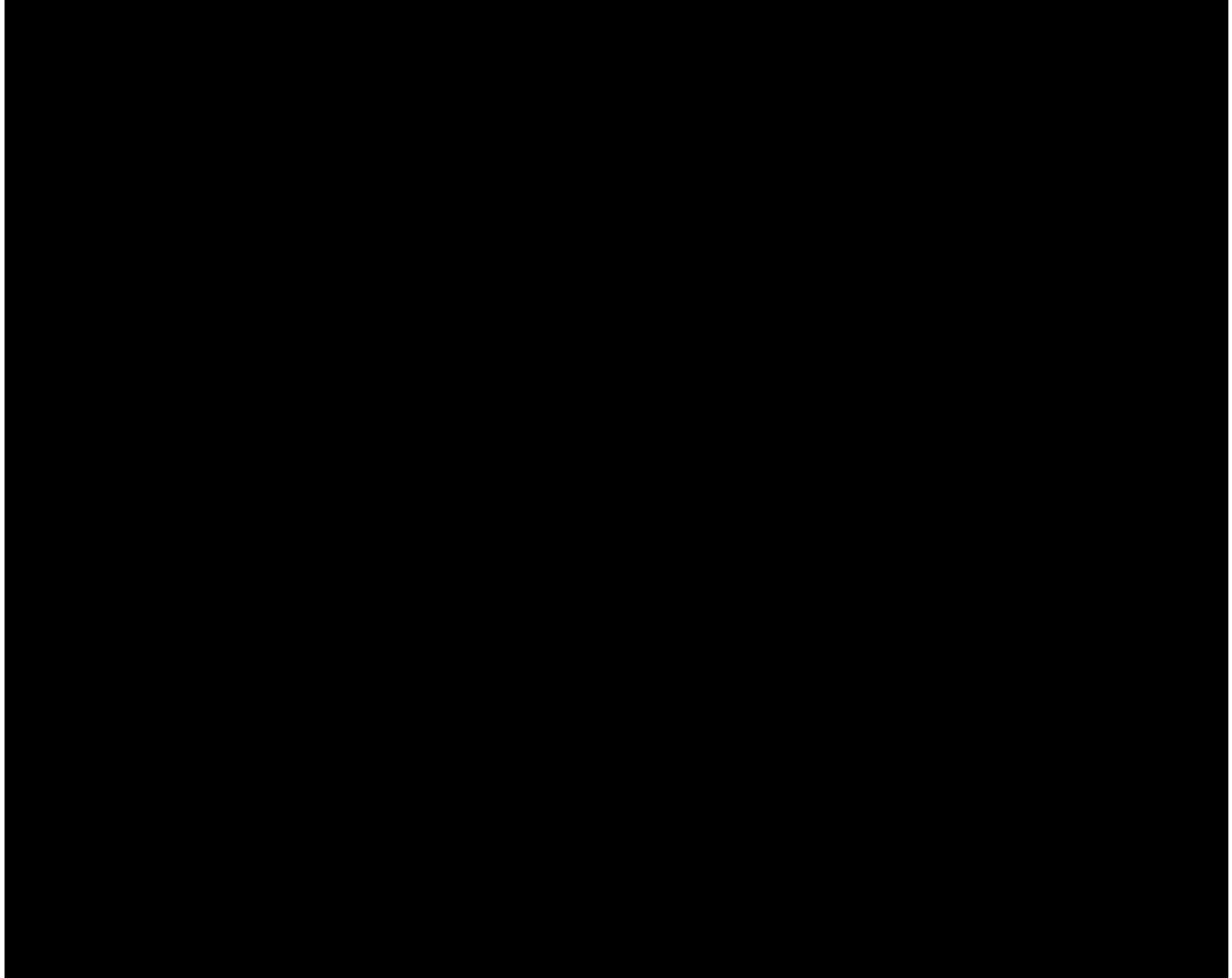


Female A.G. | Male A.G. | Mating | Searching for hosts | Parasitizing


A. gifuensis | Eclosion | Pupa | Larvae | Hatching into parasitized mummy

The whole process lasts for 10 to 15 days. Aphids (*Myzus persicae*) died when the *A. gifuensis* hatched in the aphid body into a parasitized mummy.



How to properly transmit this biocontrol technology to the growers and field technicians, and to equip smallholders with this technology and enable them to achieve greater performance?

Step 1 Scientific research

1 Break through the winter breeding conservation problem of Aphid and *Aphidius gifuensis.*

- The proper host plant with highly resistance of TMV was selected such as Yunyan 203, radish, Chinese cabbage.

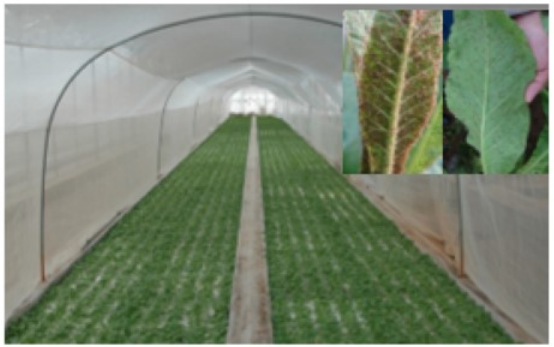





Step 1 Scientific research

1 Broke through the winter breeding conservation problem of Aphid and *Aphidius gifuensis.*

- **Alternative winter breeding conservation methods were built.**



Floating Seedling conservation system：the characteristics of the storage period is short, fast reproduction.

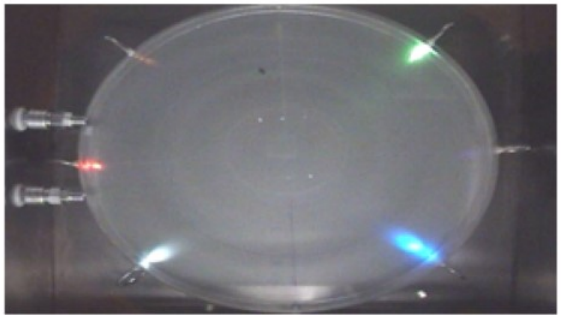
Mature plant conservation system：a long storage period, strong individual.

Cool conservation system：good for long distance transportation, cuting off the effect of *Pachyneuron aphidis (bouche)*, lower cost.

Step 1 Scientific research

2 Solve the problem of degradation and Hyperparasitoids.

- Using cycle selection method to do detoxification, purification and rejuvenation for aphid and *Aphidius gifuensis*.
- Adopting the method of artificial strip, light trapping to eliminate hyperparasitism.
- Improves the quality of *Aphidius gifuensis* individuals and groups.



Cycle selection

Light trapping

Artificial strip

Step 1 Scientific research

3 Invent the technology of aphids inoculation and transfer: the main technical points were clear.

Transfer time : Tobacco plants grow 6 - 8 effective leaves

Innoculation method : picking, tearing, erasing, rod method.

Innoculation quantity : 20-30 head/plant.

Breeding conditions : Temperature: 17 ℃ to 27 ℃, humidity: 50%-80%.

Breeding time : 15 d-20 d.

Picking transfer method

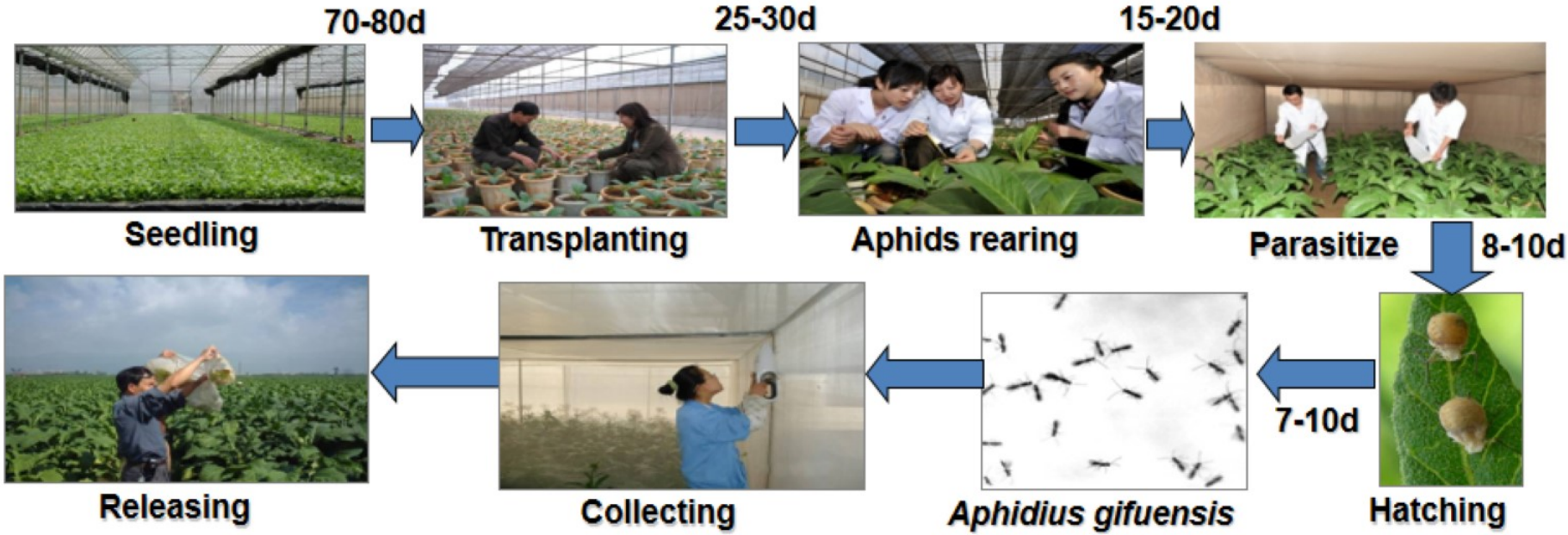
Tearing transfer method

Erasing transfer method

Rod transfer method

Step 1 Scientific research

4 Establish the method of *Aphidius gifuensis* large-scale breeding .



Process of *Aphidius gifuensis* large-scale breeding by mature plant

Step 1 Scientific research

5 Integrate the *Aphidius gifuensis* high-density breeding technology.

Aphids

Rearing by rod transfer method

Rearing by erasing transfer method

mature larva

parasitism

Parasitized mummy

Aphidius gifuensis

Releasing

Process of *Aphidius gifuensis* large-scale high density breeding by seedling plant

Step 1 Scientific research

6 Develop efficient and convenient releasing methods.

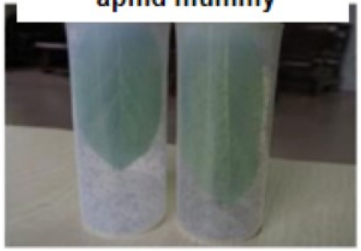
Collecting

A.gifuensis auto-collector

Auto collecting & equipment

Storage

Products of parasitized aphid mummy



Living A.gifuensis holder

Transportation

Living A.fifuensis transportation

Seedling with parasitized aphid mummy

Releasing

cards

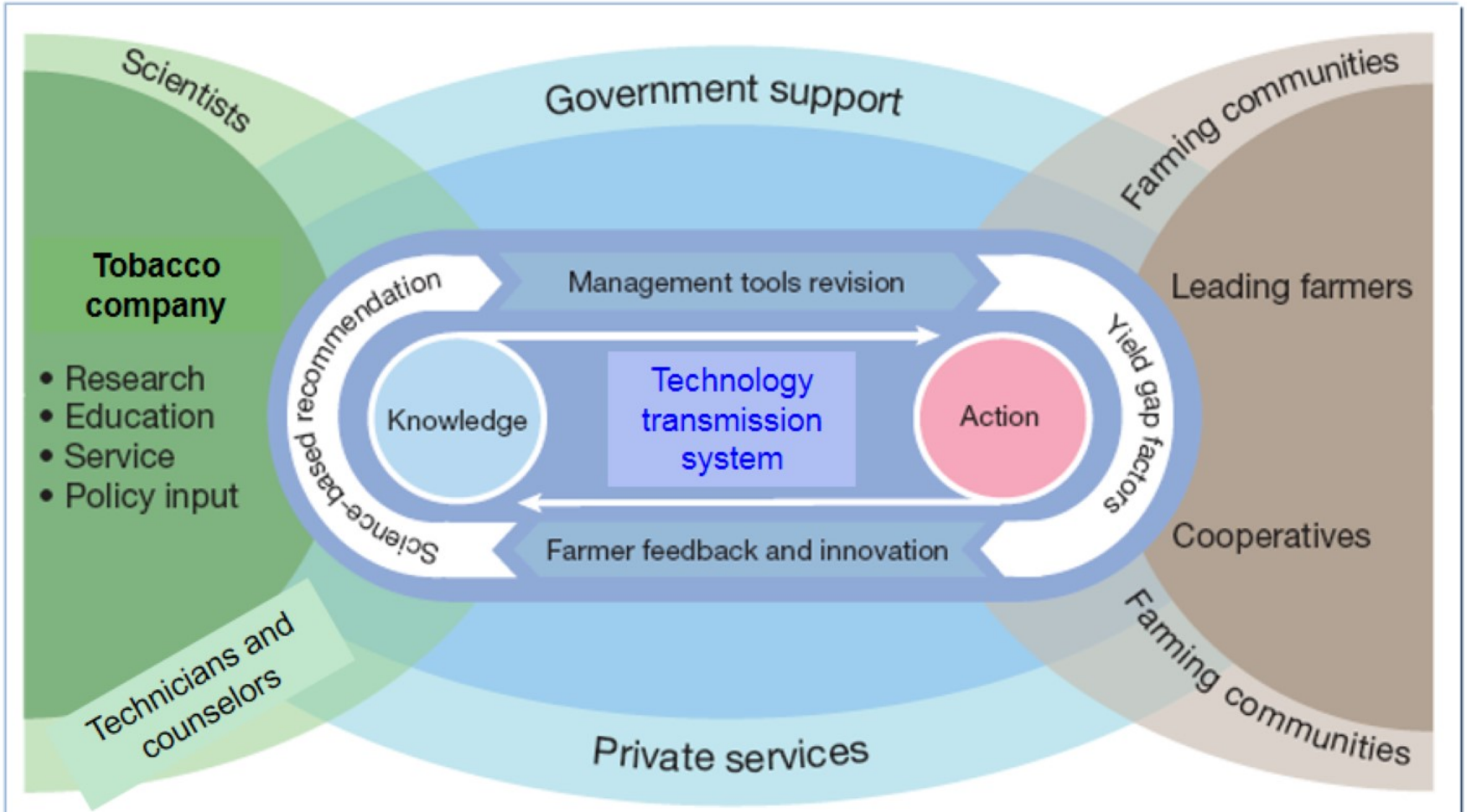
Cages

Fixed and mobile releasing

Step 2 Develop technical standardization

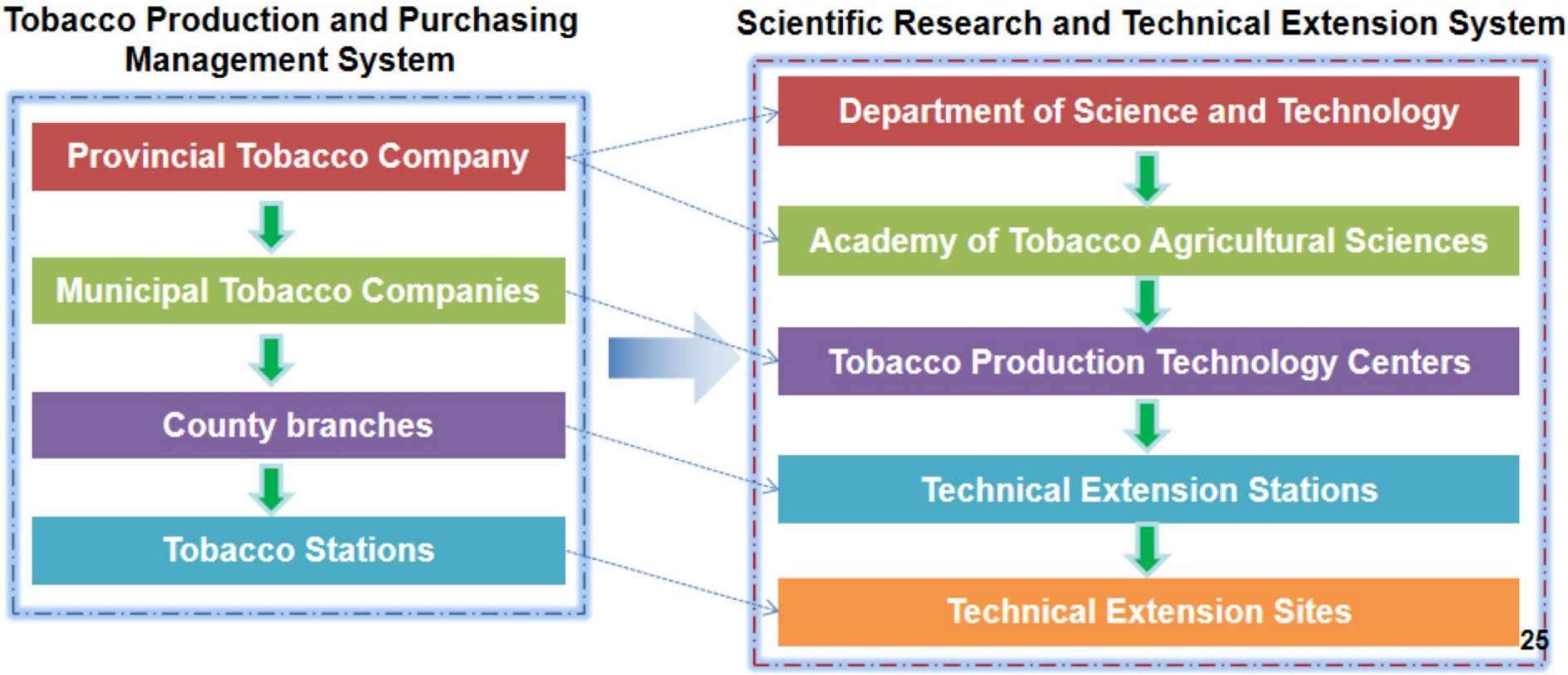
Extension based on the techical standardization

Step 3 Training and Extension



Step 3 Training and Extension

Technology transmission system



Training system

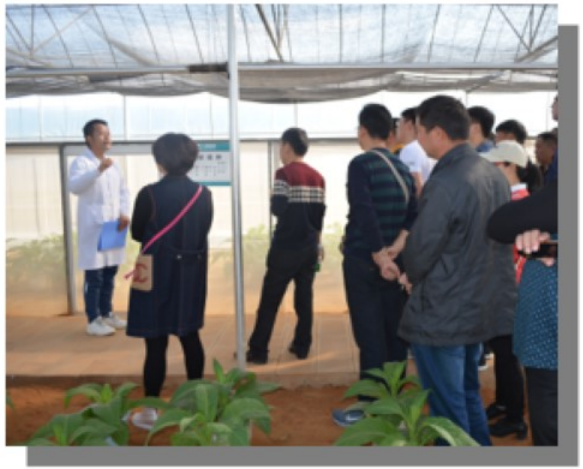
1 The 1st level training for technical managers

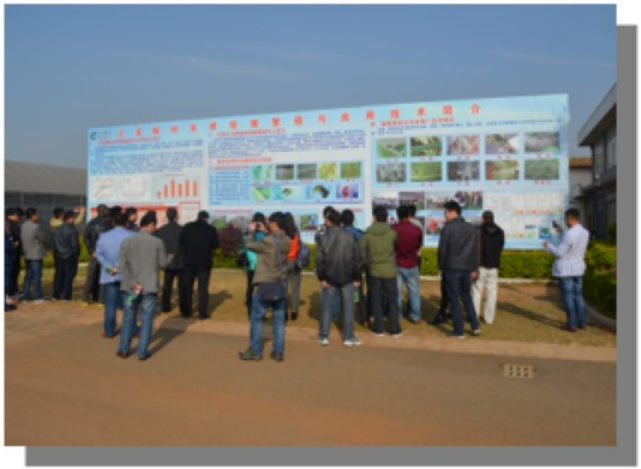
Provincial level training: 100 technical managers were trained

2 The 2nd level training for technical backbones

Municipal level training: 1,000 technical backbones were trained

3 The 3rd level training for technicians





County level training: 2,000 technicians were trained

4 The 4th level training for counselor and leading farmers

Tobacco station level training: 460,000 growers were trained

Training and Extension Platform

Yuxi Extension Station

Dali Extension Station

Honghe Extension Station

Wenshan Extension Station

Parasitized aphid with seedling——releasing to field directly

Releasing parasitized seedling

Releasing living adults of *Aphidius gifuensis*

Parasitic natural enemy——*Aphidius gifuensis*
Mass Rearing Station

Using the seedling float system to propagate the *Aphidius gifuensis*

Stereo seedling system for *Aphidius gifuensis* mass rearing

Stereo seedling system for *Aphidius gifuensis* mass rearing

6000-10000 *Aphidius gifuensis* per plants.

28 plants per small green house.

16.8 thousands *Aphidius gifuensis* per green house.

Releasing for 6 hectares.


黑龙江省
吉林省
辽宁省
内蒙古自治区
新疆维吾尔自治区
甘肃省
北京市
天津市
河北省
宁夏回族自治区
陕西省
山西省
山东省
青海省
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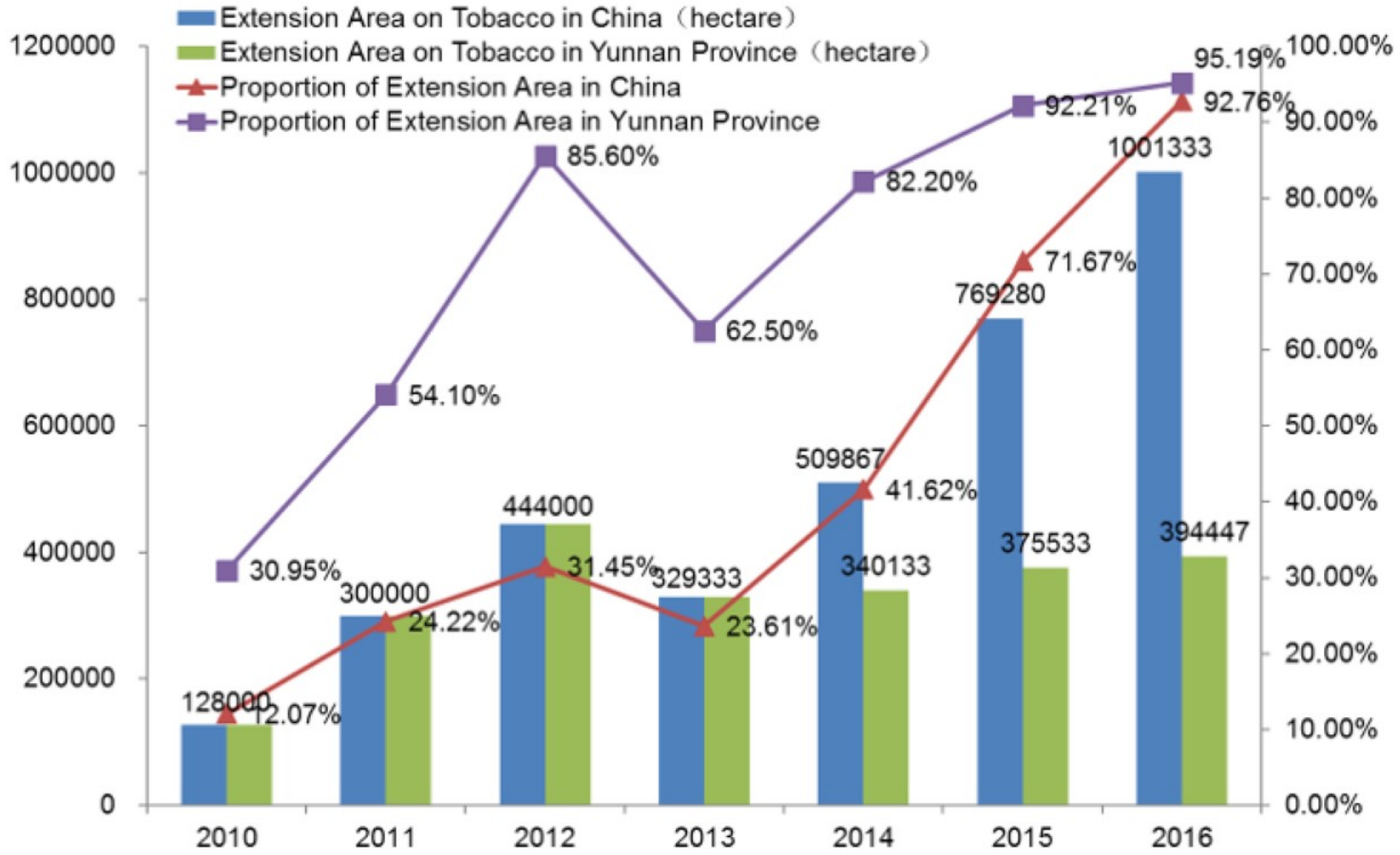
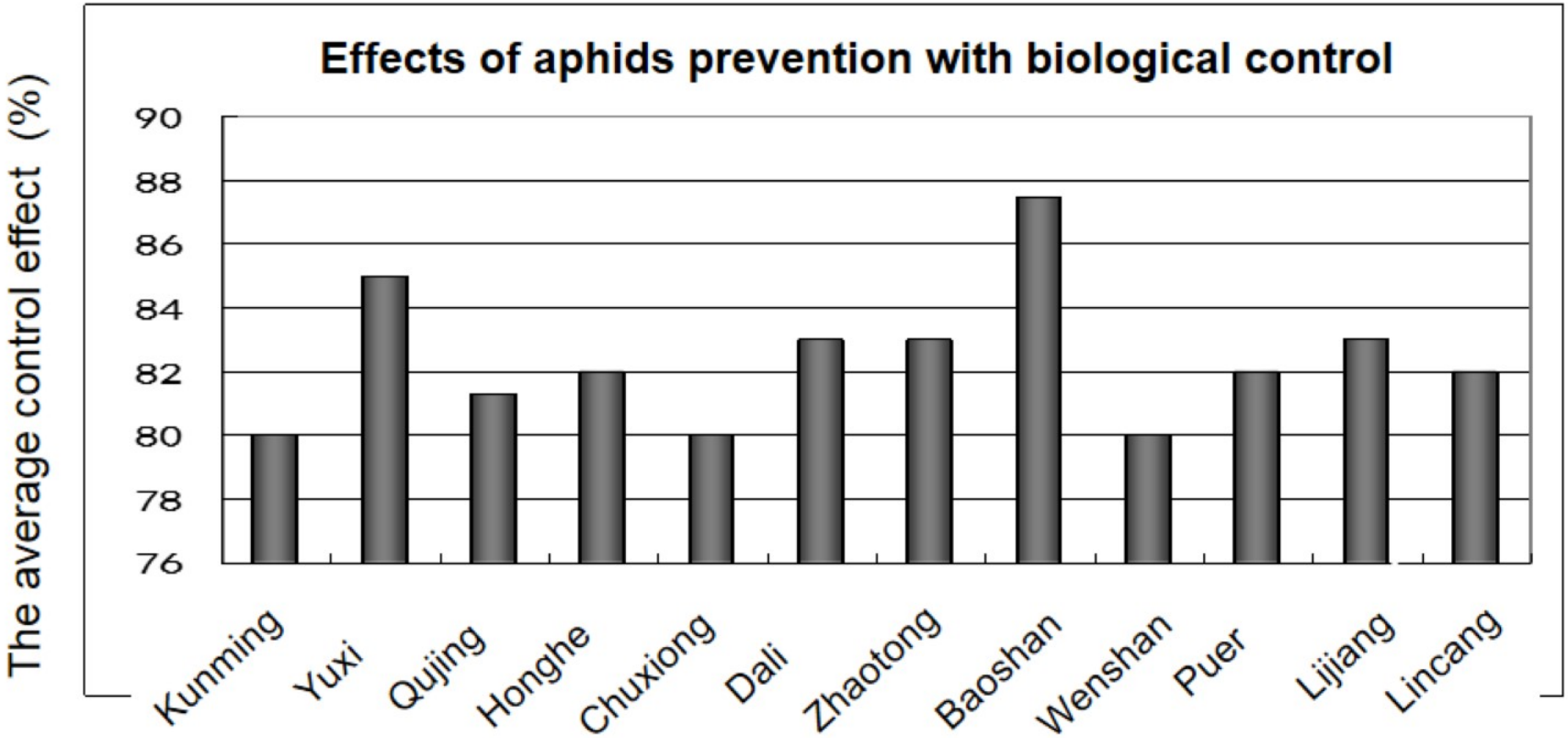
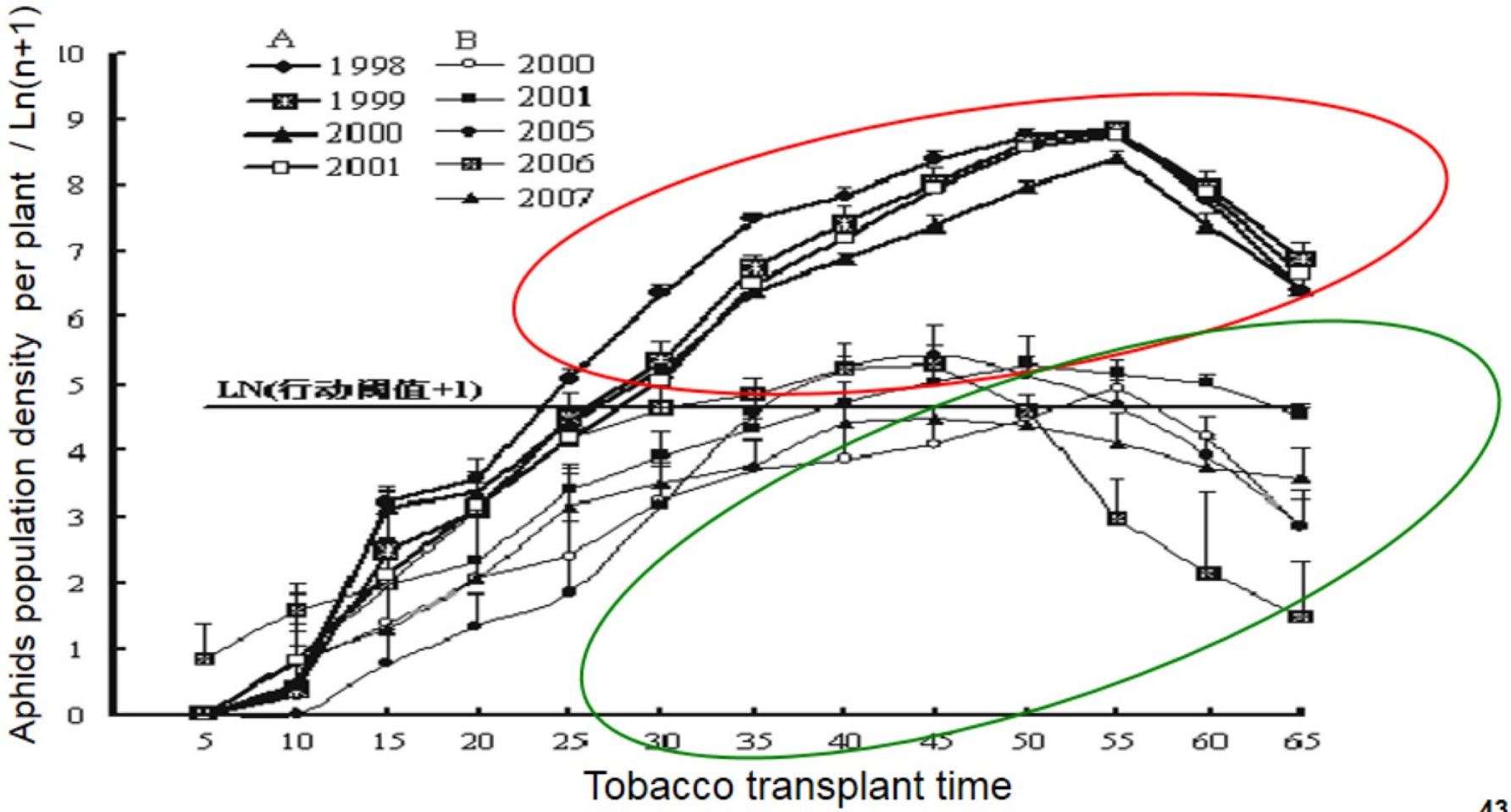
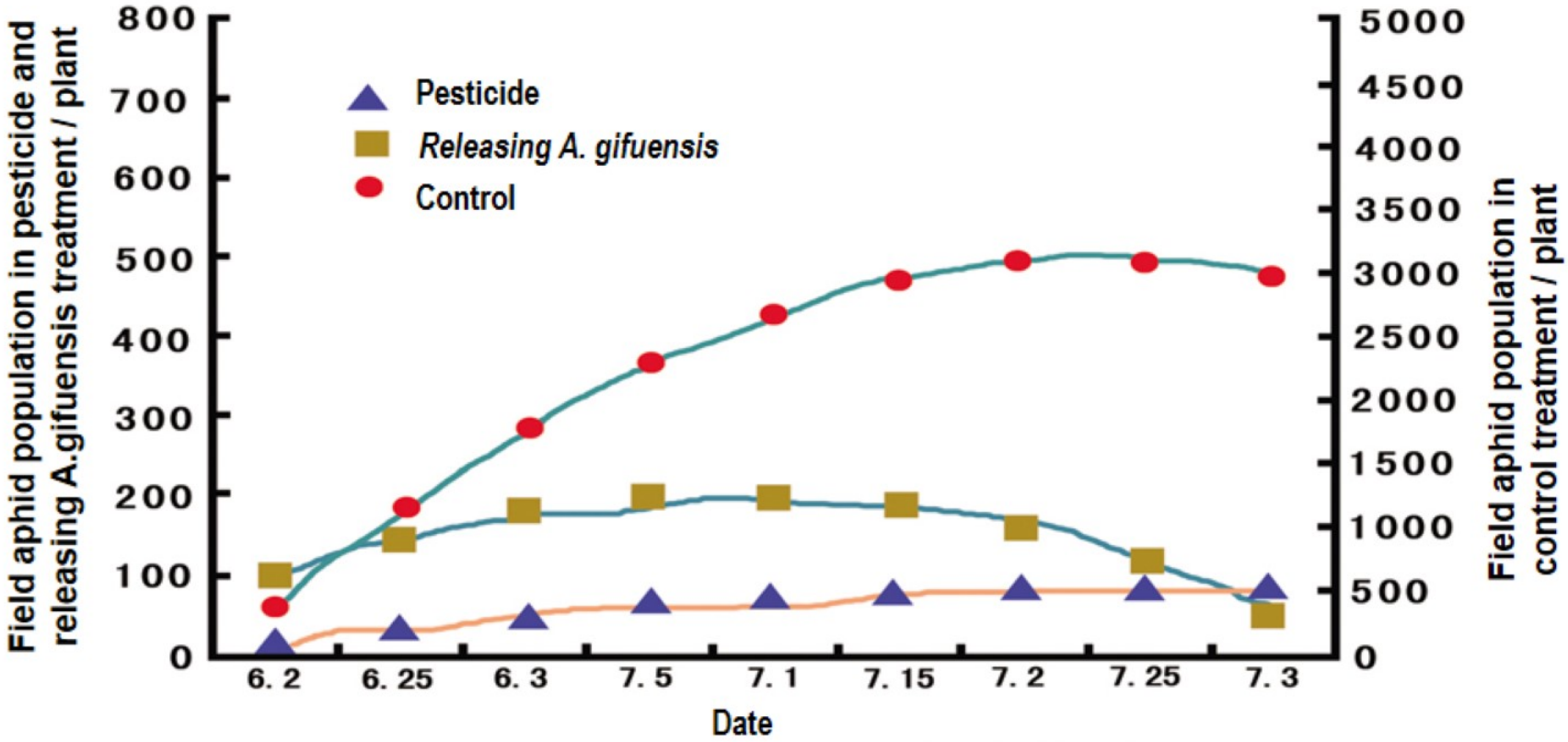
Extension in Yunnan and China




Effects of aphids prevention with biological control
The average control effect (%)
90
88
86
84
82
80
78
76
Kunming
Yuxi
Qujing
Honghe
Chuxiong
Dali
Zhaotong
Baoshan
Wenshan
Puer
Lijiang
Lincang


A
1998
1999
2000
2001
B
2000
2001
2005
2006
2007
LN(行动阈值+1)
Aphids population density per plant / Ln(n+1)
0
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30
35
40
45
50
55
60
65
Tobacco transplant time



The dynamic of field aphid populations

Contrasting the cost of extension between pesticides and biocontrol

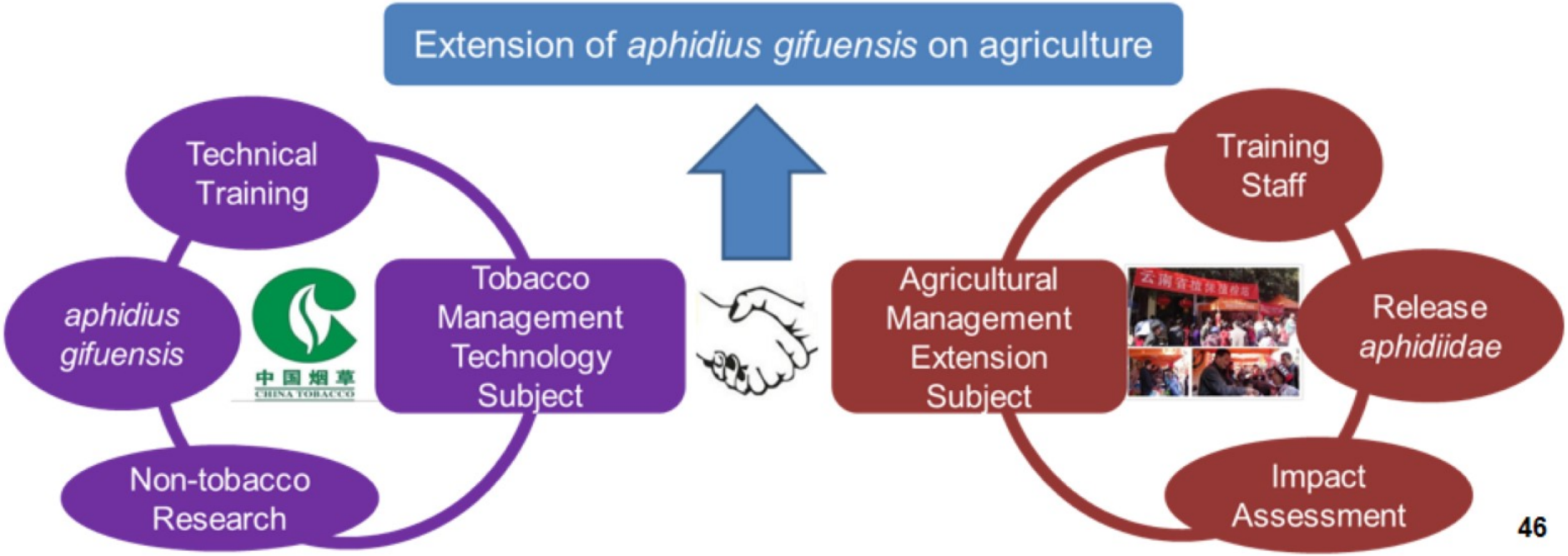
Treatments	Costs	Items	
Pesticide	1,620 ¥ (per hectare)	Costs of pesticides	90 ¥ × 3 times = 270 ¥
		Costs of labor	450 ¥ × 3 times = 1,350 ¥
Biocontrol	87.9 ¥ (per hectare)	Costs of facilities	24.9 ¥
		Costs of mass rearing	33.0 ¥
		Costs of releasing	30.0 ¥

Extension in Yunnan and China

1. Define the Subject of Extension——One Stem with branches

Stem ——Enterprise

Branches ——Governments, Farmers and other Resources

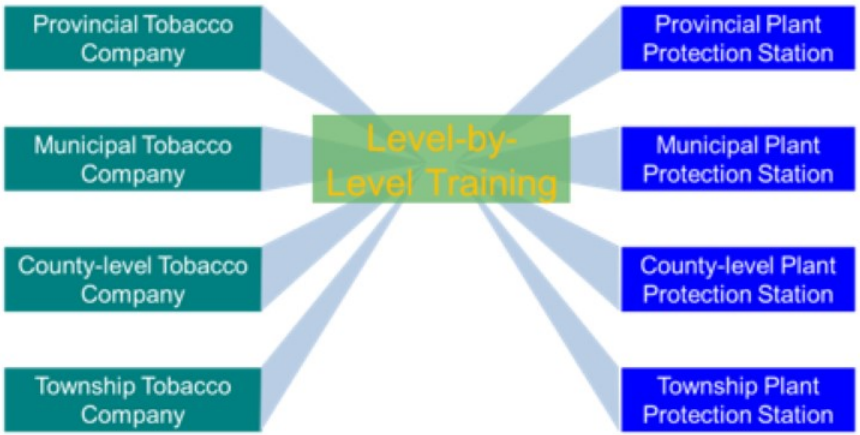


Extension in Yunnan and China

2. Define the Way of Extension——One Body with Two Wings

Body——Project Implementation

Wings——Technical Training and Assessment



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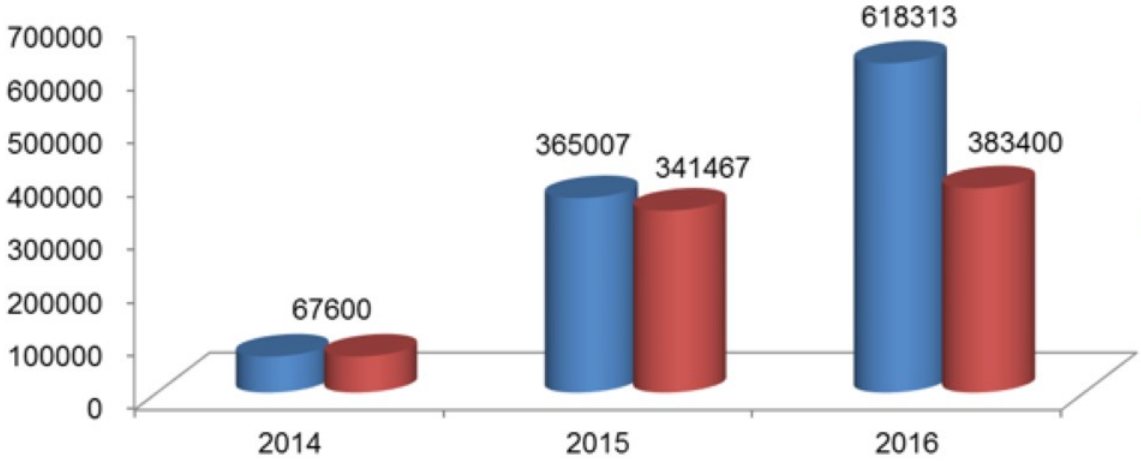
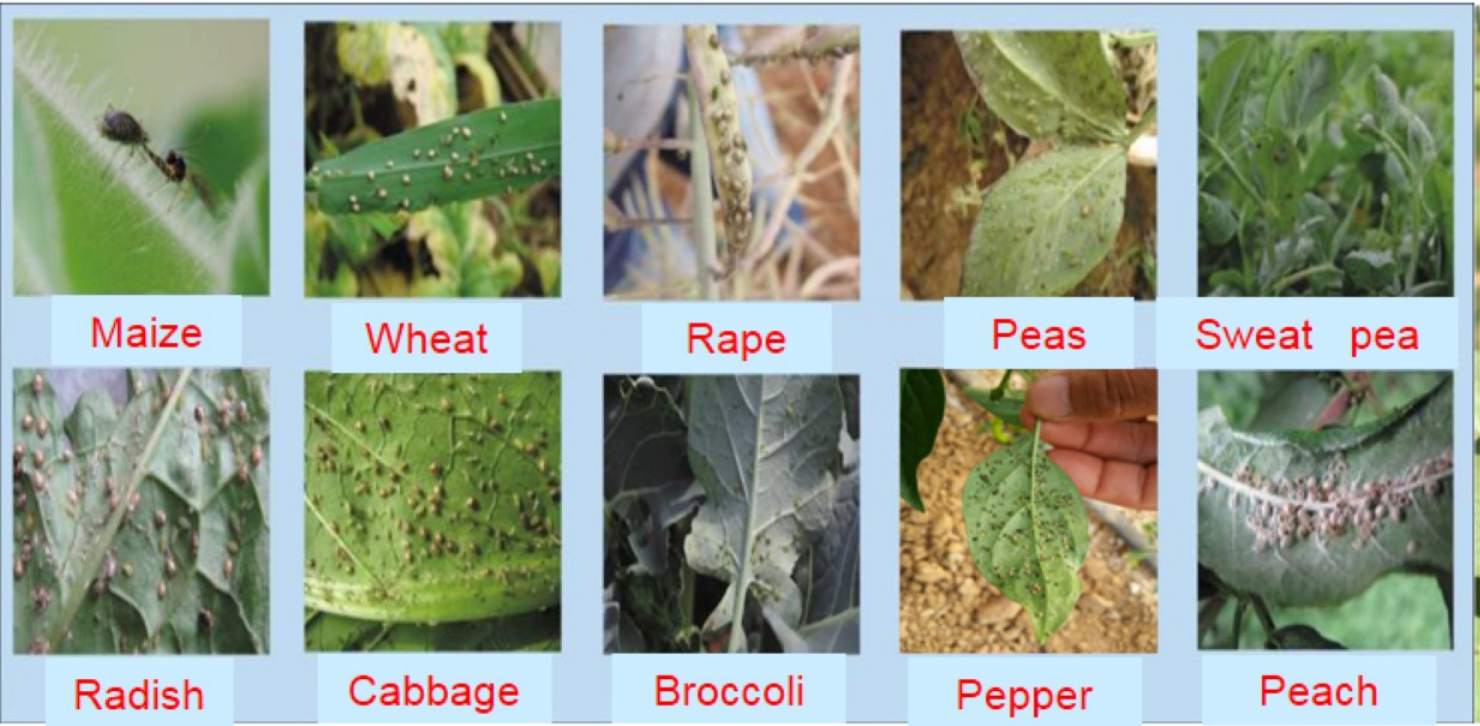
重点项目合同

Extension in Yunnan and China



- **Extending this biocontrol technology to other crop production: the effect of aphids control on average is nearly 60%.**




Broad bean



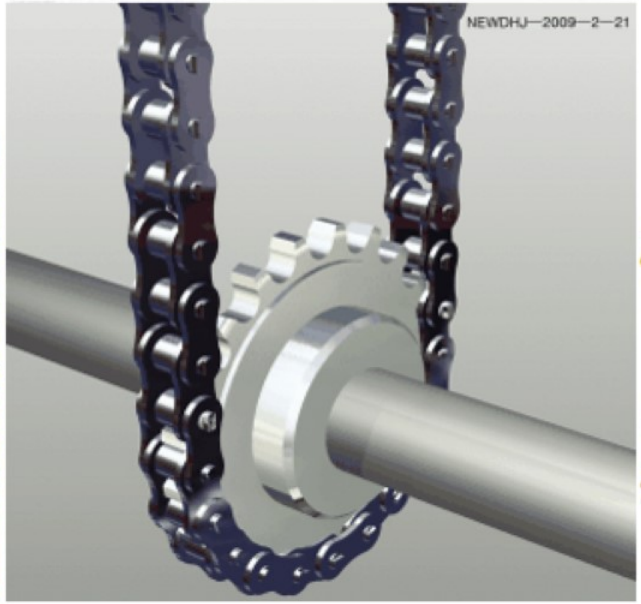
The tobacco industry and tobacco company are happy!


The farmers and growers are also happy!

Research → Science and Technology → Training → Extension

Input

Output



Acknowledgements

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