IPPC High-level Symposium on Cooperation of the Phytosanitary Measures among the Chinese Initiative “One Belt” Countries

The Research System of Plant Health in China

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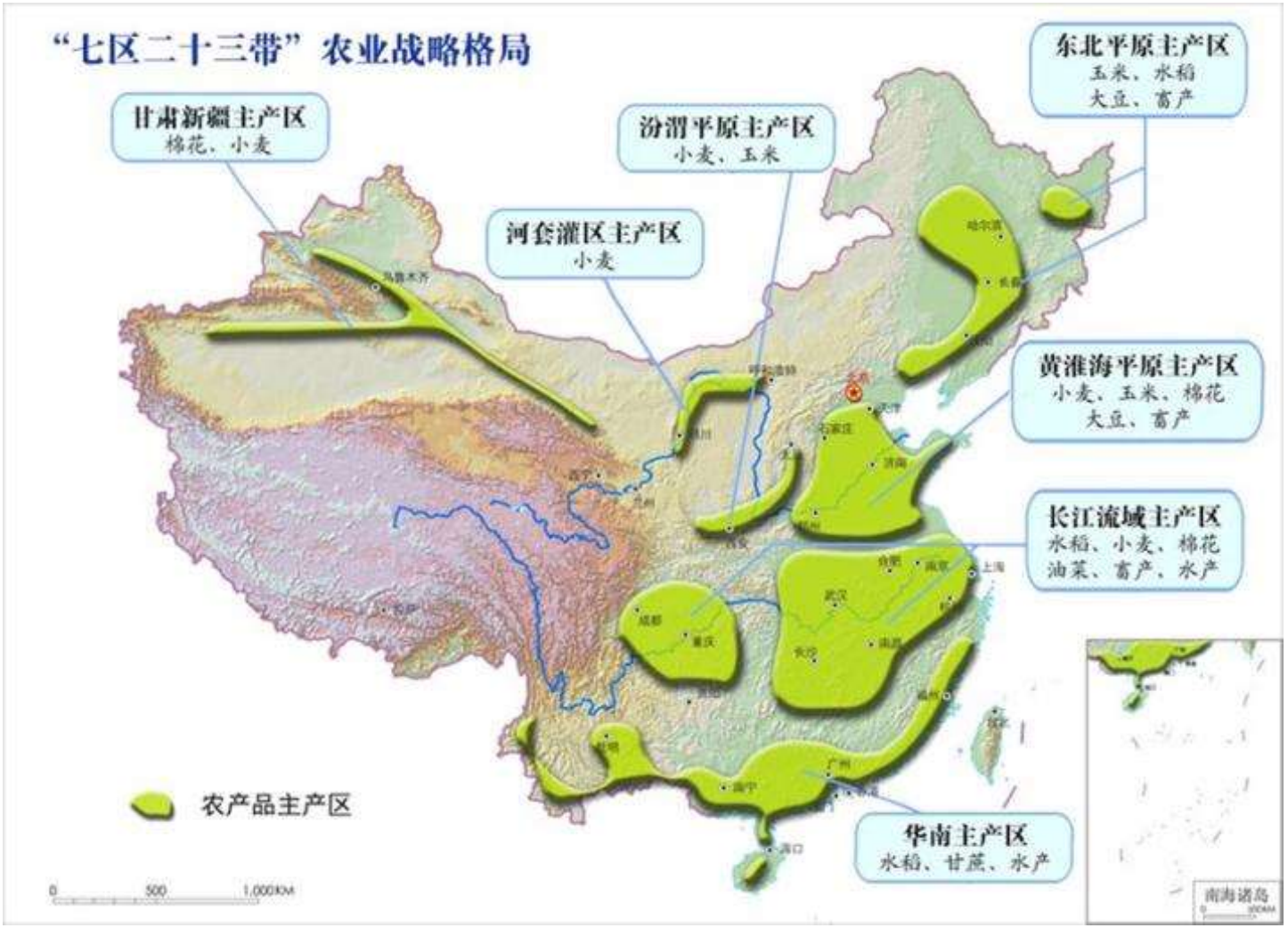
27-30 May 2019, Xi-An, China

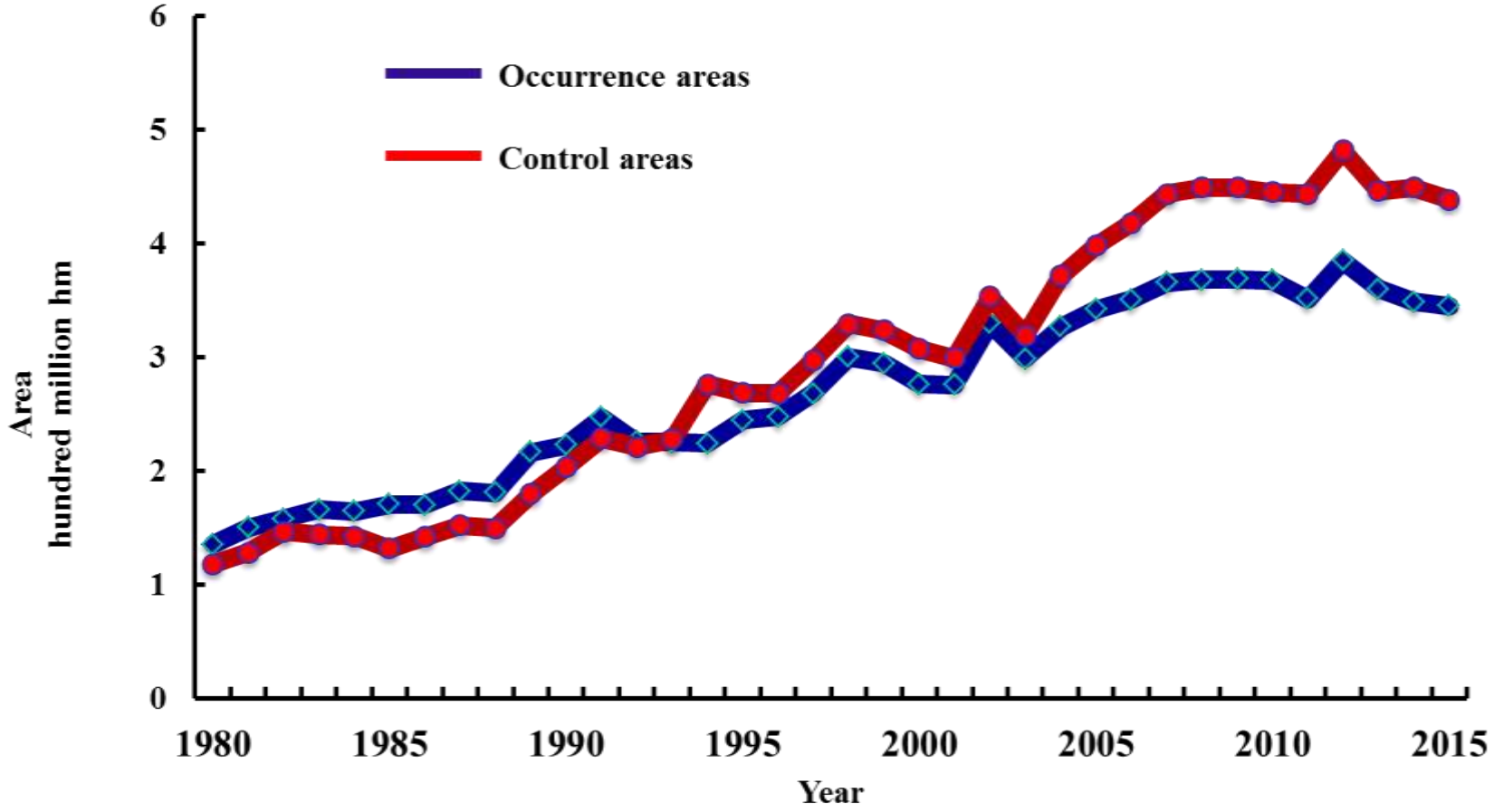
Contents

- Introduction
- Research institutions and funding sources
- Consideration and suggestion for future development

Overview of crop diseases and insect pests in China



Major Pest Monitoring and Control



Major plant diseases and insect pests

- About 120 species
- Type Ⅰ: 14 species, Type Ⅱ: about 100 species

Type Ⅰ: More than 100 million mu per year

actual loss over one million tons per year

have a Huge influence on politics and society

Wheat (5) : wheat aphids, stripe rust, gibberellic disease, powdery mildew, sheath blight

Rice (4): rice planthopper, rice leaf roller, rice blast, rice sheath blight

Maize (2): corn borer, corn leaf spot disease

Polyphagous pests (3): locust , armyworm, meadow moth

Wheat stripe rust

Rice planthopper

Brown rice planthopper

Nilaparvata lugens(Stal))

White-backed planthopper

Sogatella furcifera

Small brown rice planthopper

Laodelphax striatellus

Rice stem borers

- Long distance migration, known as “two-specific migration insects” on rice with the rice planthopper.
- A common pest in most countries that produce rice in Southeast Asia.



Rice blast

Rice sheath blight

水稻纹枯病
Rice sheath blight

sheath blight 纹 枯 病

Rice virus diseases

Armyworm

- **Major migratory pests**
- **Damage on winter wheat and corn**
- **Centralized hazards in Northeast, North China and Huanghuaihai region in China.**

Epidemic of invasive plant

Of the 100 most threatening invasive species in the world, more than 50 were found in China.

In the past 10 years, more than 20 new species spread to our country with an average increment of 1~2 species per year, and the intrusion speed was dozens of times than before 1980s

Fall armyworm

Damage caused by Fall armyworm

CABI plantwise

Feeding by young caterpillars results in semi-transparent patches on the leaves called windows.

Young caterpillars can spin silken threads which catch the wind and transport the caterpillars to a new plant.

Feeding through the whorl can cause a line of identical 'shot' holes, when the leaf unfurls.

As they develop, Fall armyworm move permanently into the whorl. This means that it is difficult to detect early infestations.

Feeding can cause the whorl and upper leaves to be a mass of holes, ragged edges, and caterpillar poo (called 'frass').

The caterpillars usually burrow into the side of the cob.

Fall armyworm infestation causes stunting and destruction of developing tassels and kernels.

When the caterpillars burrow into the side of the cob, damage to grains can lead to rot.

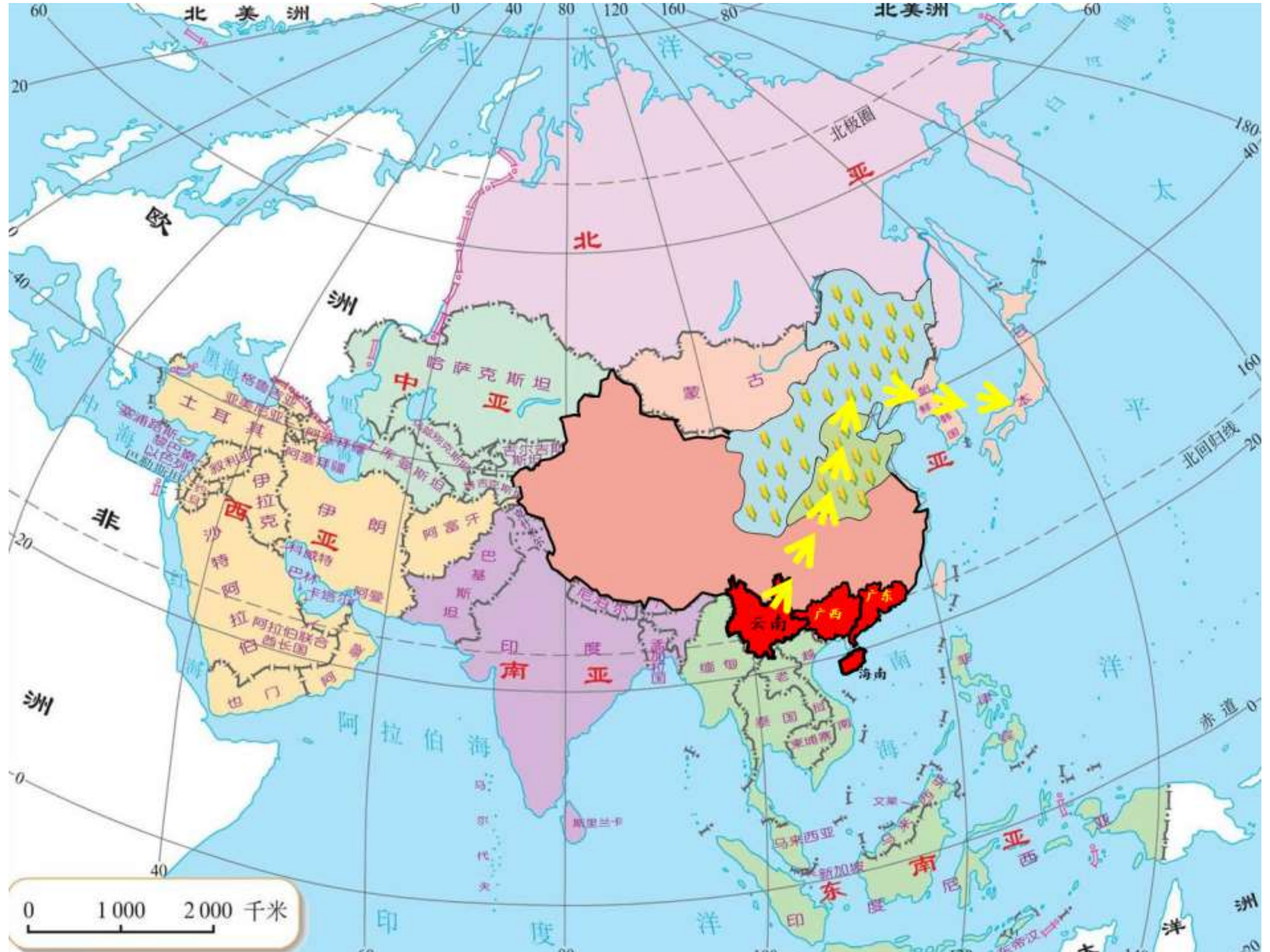
Holding a maize plant damaged by Fall armyworm.

For more info on Fall armyworm please visit:
www.plantwise.org/fallarmyworm

KNOWLEDGE FOR LIFE

Sources: FAO, CAB

Sources: China


北美洲
北冰洋
北极圈
北
亚
欧
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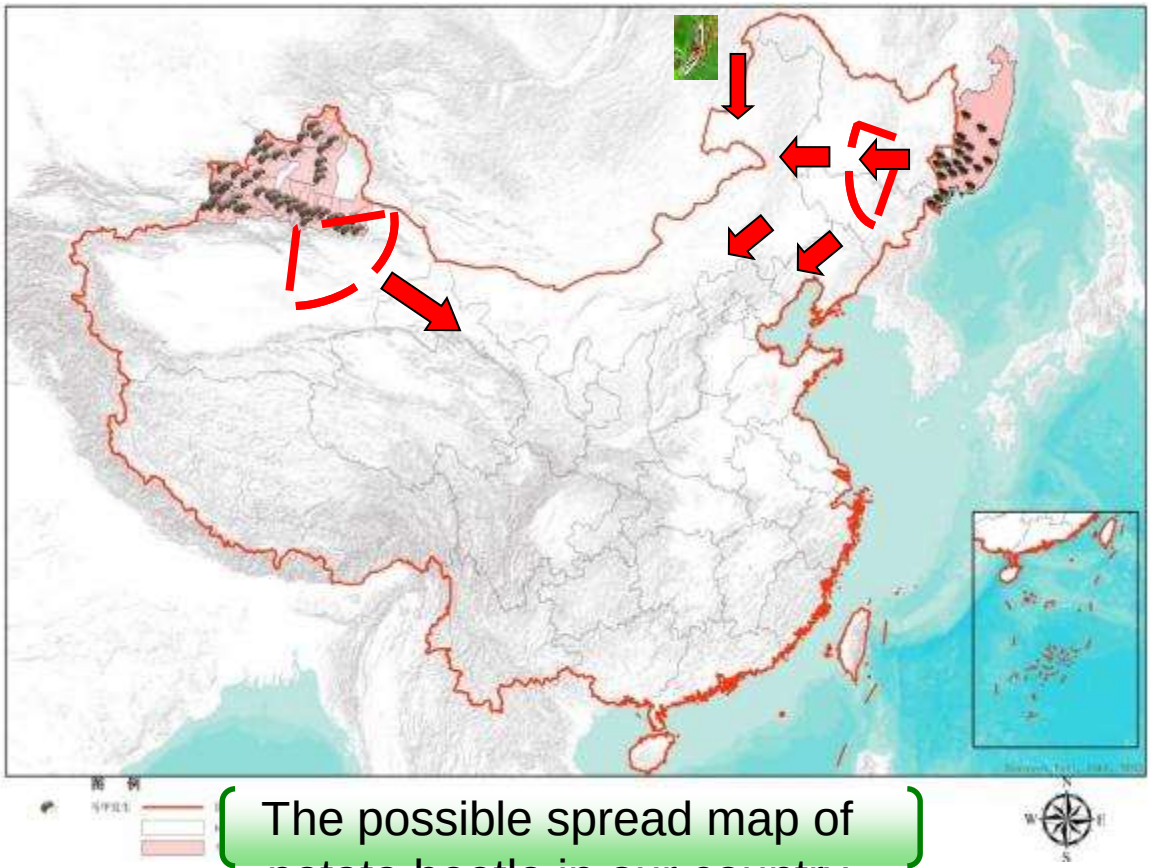
非
洲
中亚
哈萨克斯坦
蒙古
西亚
土耳其
伊拉克
伊朗
沙特阿拉伯
阿富汗
科威特
巴林
卡塔尔
阿曼
也门
阿拉伯联合酋长国
叙利亚
黎巴嫩
以色列
塞浦路斯
格鲁吉亚
亚美尼亚
阿塞拜疆
土库曼斯坦
吉尔吉斯斯坦
南亚
巴基斯坦
印度
尼泊尔
孟加拉国
斯里兰卡
马尔代夫
东亚
朝鲜
韩国
日本
云南
广西
广东
海南
东南亚
缅甸
老挝
泰国
柬埔寨
越南
马来西亚
新加坡
文莱
菲律宾
印度尼西亚
东帝汶
地中海
黑海
里海
红海
阿拉伯海
南海
印度洋
太平洋
北回归线
赤道
0 1 000 2 000 千米

Colorado potato beetle

- During World War II, the German army cast Colorado potato beetle to the British Isle of Wight.
- **Distributed in Xinjiang, and the epidemic was found in Heilongjiang , China , in 2014.**



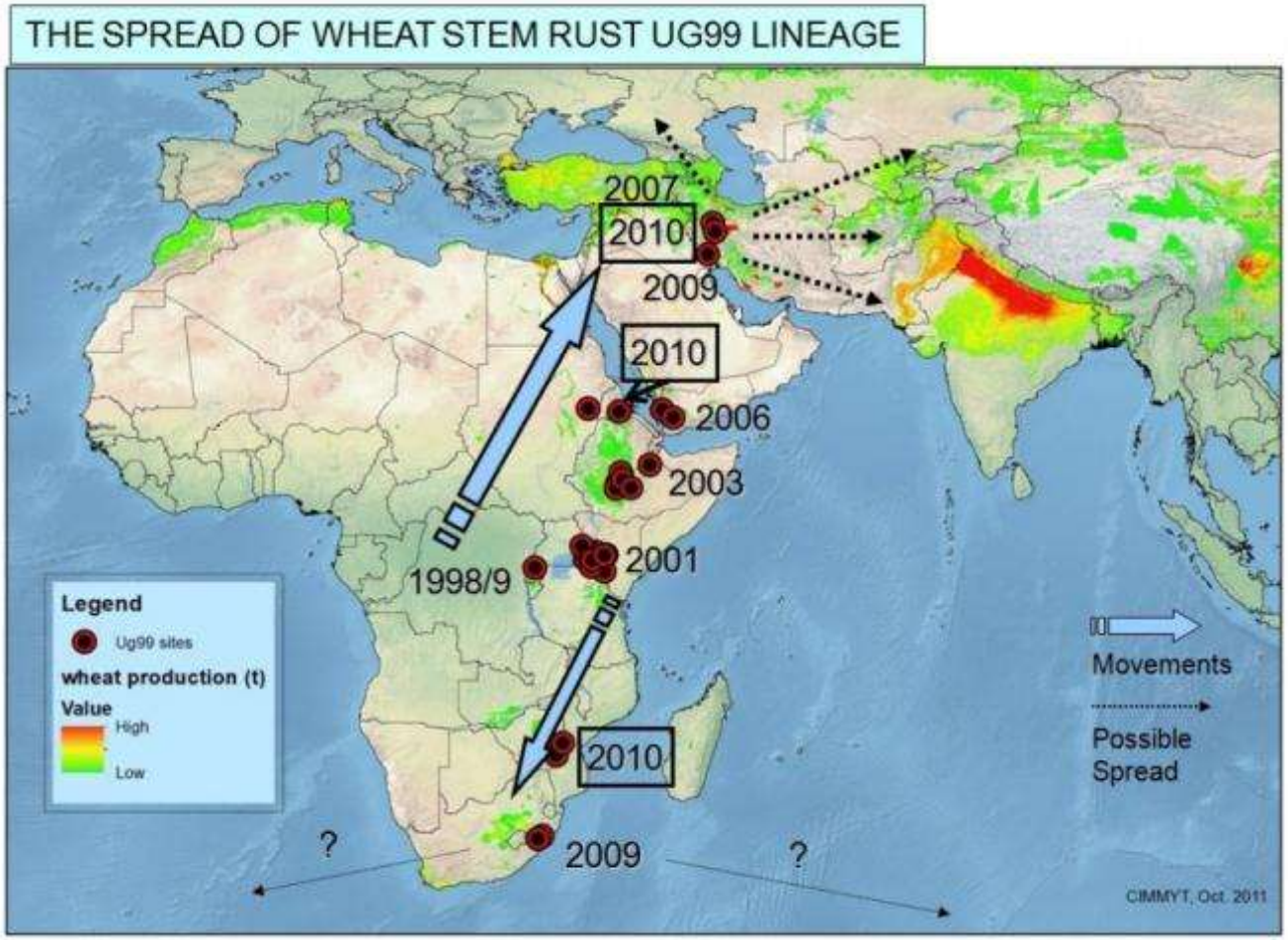
The possible spread map of potato beetle in our country

Wheat stem rust Ug99 variant

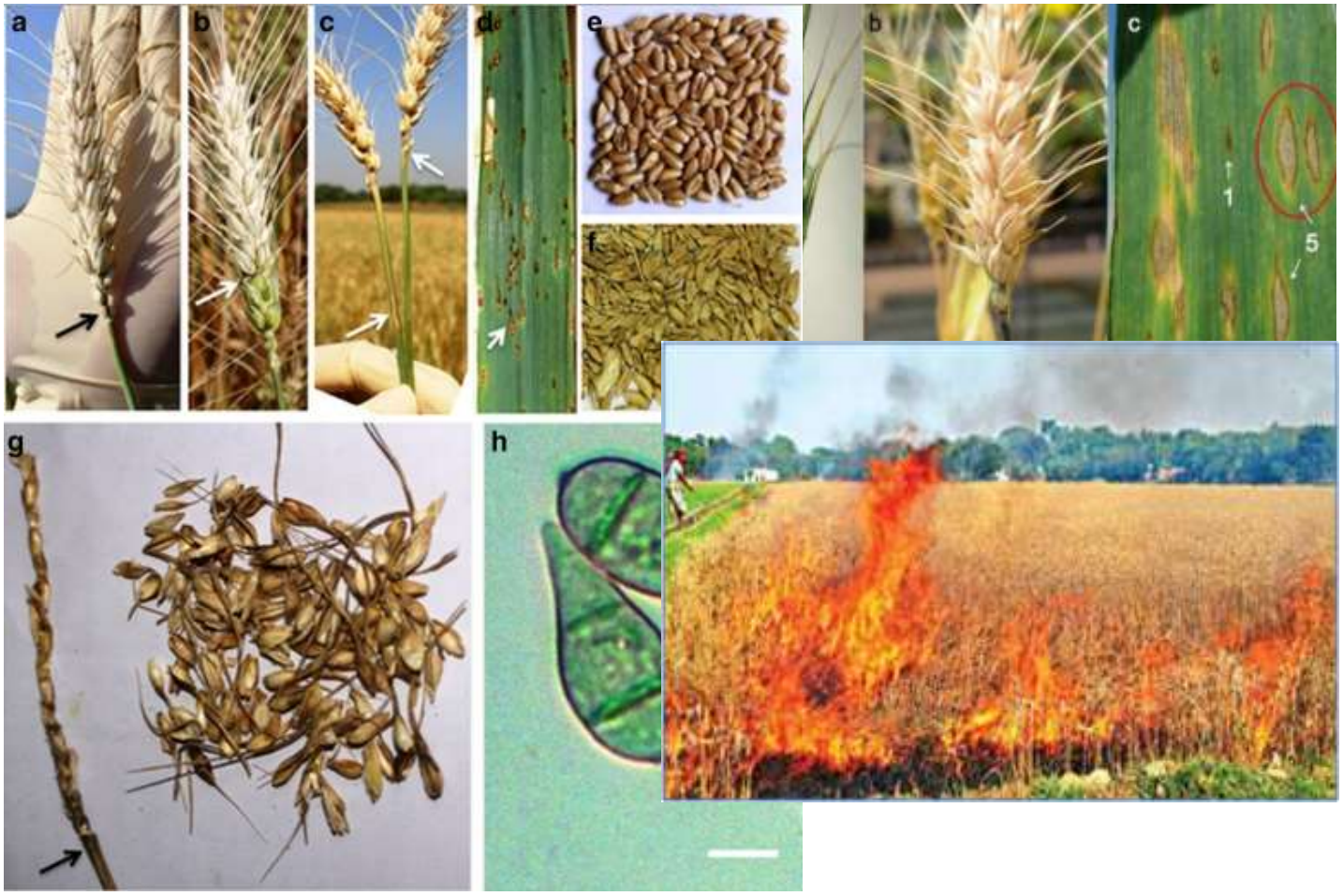
Wheat killer-Ug99, once invade our country, could cause a devastating blow to 21.3 million hm^2 winter wheat highly possibly.

In 1999, it was first discovered in Uganda.

Spread to Kenya in 2001, to Ethiopia in 2003, and over the sea to Yemen with wind in 2007.



Wheat blast



Brazil (1985) → South America → Bangladesh (2016）

→ India (suspected, 2017）

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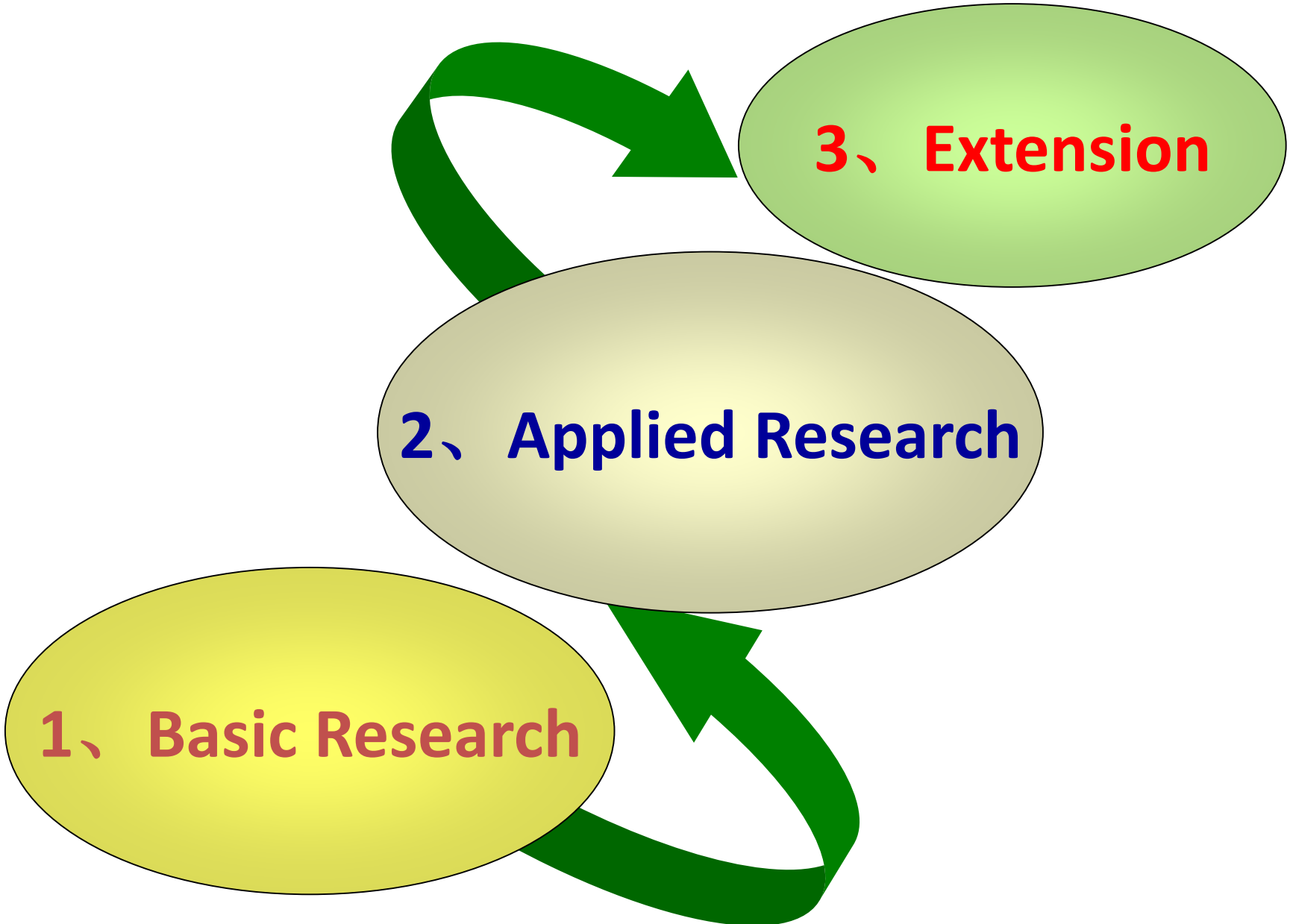
Basic Frame on Research System



Basic Research on Plant Health

Organizations

Research Institution

- Institute of Plant Protection, Chinese Academy of Agricultural Sciences
- INSTITUTE OF ZOOLOGY CHINESE ACADEMY OF SCIENCES

College/ University

- More than 30 Universities working on the basic research on plant health
- Zhejiang University
- China Agricultural University
- Nanjing Agricultural University……

Basic Research on Plant Health

Progress-*Representative papers* - (1)

nature biotechnology

ANALYSIS

Large-scale test of the natural refuge strategy for delaying insect resistance to transgenic Bt crops

Lin Jin[1], Haonan Zhang[1], Yanhui Lu[2], Yihua Yang[1], Kongming Wu[2], Bruce E Tabashnik[3] & Yidong Wu[1]

Nature

LETTER

doi:10.1038/nature14286

Two insulin receptors determine alternative wing morphs in planthoppers

Hai-Jun Xu[1]*, Jian Xue[1]*, Bo Lu[1], Xue-Chao Zhang[1], Ji-Chong Zhuo[1], Shu-Fang He[1], Xiao-Fang Ma[1], Ya-Qin Jiang[1], Hai-Wei Fan[1], Ji-Yu Xu[1], Yu-Xuan Ye[1], Peng-Lu Pan[1], Qiao Li[1], Yan-Yuan Bao[1], H. Frederik Nijhout[2] & Chuan-Xi Zhang[1]

Nature

LETTER

doi:10.1038/nature11153

Widespread adoption of Bt cotton and insecticide decrease promotes biocontrol services

Yanhui Lu[1], Kongming Wu[1], Yuying Jiang[2], Yuyuan Guo[1] & Nicolas Desneux[3]

Basic Research on Plant Health

Progress-*Representative papers*-(2)

Advances in Understanding Begomovirus Satellites

Xueping Zhou

Molecular Mechanisms of Nematode-Nematophagous Microbe Interactions: Basis for Biological Control of Plant-Parasitic Nematodes

Juan Li,[1] Chenggang Zou,[1] Jianping Xu,[2] Xinglai Ji,[1] Xuemei Niu,[1] Jinkui Yang,[1] Xiaowei Huang,[1] and Ke-Qin Zhang[1]

Novel Insights into Rice Innate Immunity Against Bacterial and Fungal Pathogens

Wende Liu,[1] Jinling Liu,[2] Lindsay Triplett,[3] Jan E. Leach,[3] and Guo-Liang Wang[1,4]

Role of Alternate Hosts in Epidemiology and Pathogen Variation of Cereal Rusts

Jie Zhao,[1] Meinan Wang,[2] Xianming Chen,[3,*] and Zhensheng Kang[1,*]

Playing on a Pathogen's Weakness: Using Evolution to Guide Sustainable Plant Disease Control Strategies

Jiasui Zhan,[1,2,*] Peter H. Thrall,[3] Julien Papaïx,[4,5] Lianhui Xie,[2] and Jeremy J. Burdon[3]

New Insights into Mycoviruses and Exploration for the Biological Control of Crop Fungal Diseases

Jiatao Xie[1,2] and Daohong Jiang[1,2,*]

Papers published in Annual Review of Phytopathology

Basic Research on Plant Health

Progress-*Representative papers*-(3)

Advances in Silkworm Studies Accelerated by the Genome Sequencing of *Bombyx mori**

Qingyou Xia,[1,†] Sheng Li,[2] and Qili Feng[3]

Invasion and Management of Agricultural Alien Insects in China

Fang-Hao Wan[*,†] and Nian-Wan Yang[†]

Red Turpentine Beetle: Innocuous Native Becomes Invasive Tree Killer in China

Jianghua Sun,[1] Min Lu,[1] Nancy E. Gillette,[2,*] and Michael J. Wingfield[3]

Molecular Mechanisms of Phase Change in Locusts

Xianhui Wang[1] and Le Kang[1,2,*]

Biology, Ecology, and Management of the Diamondback Moth in China

Zhenyu Li,[1] Xia Feng,[1,*] Shu-Sheng Liu,[2] Minsheng You,[3] and Michael J. Furlong[4]

Whitefly Parasitoids: Distribution, Life History, Bionomics, and Utilization

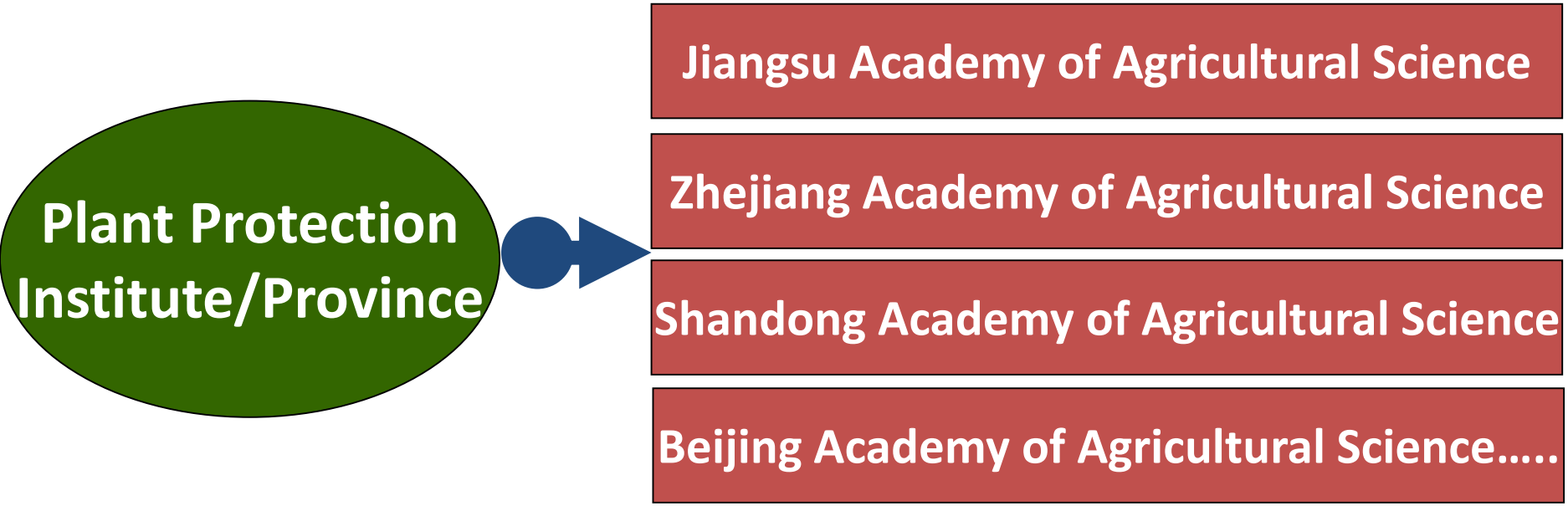
Tong-Xian Liu,[1,*] Philip A. Stansly,[2] and Dan Gerling[3]

6 papers published in Annual Review of Entomology

Applied Research on Plant Health

Organizations

CAAS and some universities, working on both basic and applied research, and more than 30 local plant protection institutions for each Province are also the main organizations working on applied research



Applied Research on Plant Health

Progress-*Representative awards -(1)*

- **2012-First Prize of National Science and Technology Progress Award:** Construction and application of comprehensive management technology system of wheat stripe rust fungus source base.
  Prof. Wanquan Chen from IPP-CAAS.
- **2012-Second Prize of National Science and Technology Progress Award:** Insecticide resistance mechanism and key techniques of monitoring and management for the important crop pathogens,
  Prof. Mingguo Zhou from Nanjing Agricultural University.
- **2012-Second Prize of National Science and Technology Progress Award:** Construction and application of three stage breeding system for citrus varieties.
  Prof. Changyong Zhou from CRI-CAAS.

Applied Research on Plant Health

Progress-*Representative awards -(2)*

- **2013-Second Prize of National Science and Technology Progress Award:** Major agricultural invasive species early warning and monitoring technology, Prof. Fanghao Wan from IPP-CAAS.
- **2014-Second Prize of National Science and Technology Progress Award:** The development and application of a new type of agricultural fungicide natural anthraquinone compound, Prof. Dazhao Yu from Hubei Academy of Agricultural Science.
- **2014-Second Prize of National Science and Technology Progress Award:** Development and application of new pesticide for preventing and controlling crop virus disease and vector insects.
  Prof. Baoan Song from Guizhou University.

Applied Research on Plant Health

Progress-*Representative awards-(3)*

- **2014-Second Prize of National Science and Technology Progress Award:** Molecular detection techniques and species identification of important plant pathogens and their application in port quarantine.
  Prof. Jianping Chen from Zhejiang Academy of Agricultural Sciences.
- **2015-Second Prize of National Science and Technology Progress Award:** Key technologies and applications of high efficiency and reduction of pesticide based on biological target.
  Prof. Xiwu Gao from China Agricultural University.
- **2015-Second Prize of National Science and Technology Progress Award:** Mechanisms for epidemic of rice plant hopper and its sustainable control.
  Prof. Jichao Fang from Jiangsu Academy of Agricultural Sciences.

Applied Research on Plant Health

Progress-*Representative awards-(4)*

- **2016-Second Prize of National Science and Technology Progress Award:** Epidemics of rice stripe and rice black-streaked dwarf diseases and their green.
  Prof. Yijun Zhou from Jiangsu Academy of Agricultural Sciences.
- **2016-Second Prize of National Science and Technology Progress Award:** Technology establishment for high efficiency and low risk of pesticides and aplication.
  Prof. Yongquan Zheng from IPP-CAAS.
- **2017-Second Prize of National Science and Technology Progress Award:** Essential technologies for control of disease and insect by crop diversity and their application.
  Prof. Youyong Zhu from Yunnan Agricultural University.

Applied Research on Plant Health

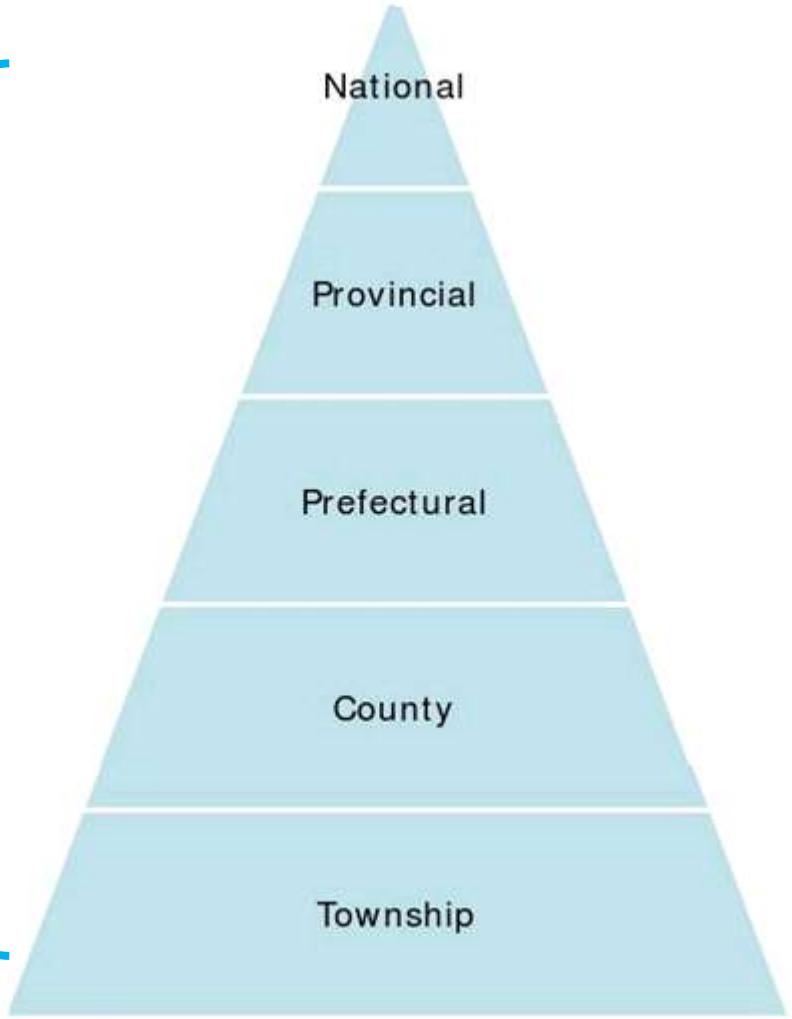
Progress-*Representative awards-(5)*

- **2018-Second Prize of National Science and Technology Progress Award:** Technologies for control of vegetable diseases caused by oomycetes.
  Prof. Xiuguo Zhang from Shandong Agricultural University.
- **2018-Second Prize of National Science and Technology Progress Award:** Mechanism for pathogenesis and techniques for control of fruit tree rot disease.
  Prof. Lili Huang from Northwest A&F University.
- **2018-Second Prize of National Science and Technology Progress Award: New target and aplication of fungicide.**
  Prof. Mingguo Zhou from Nanjing Agricultural University.

Extension

Framework of extension system

Five levels of extension system



The National Agro-Tech Extension and Service Center (NATESC)

↓

Provincial-Township Plant Protection Station
or
Extention Service Station

Extension

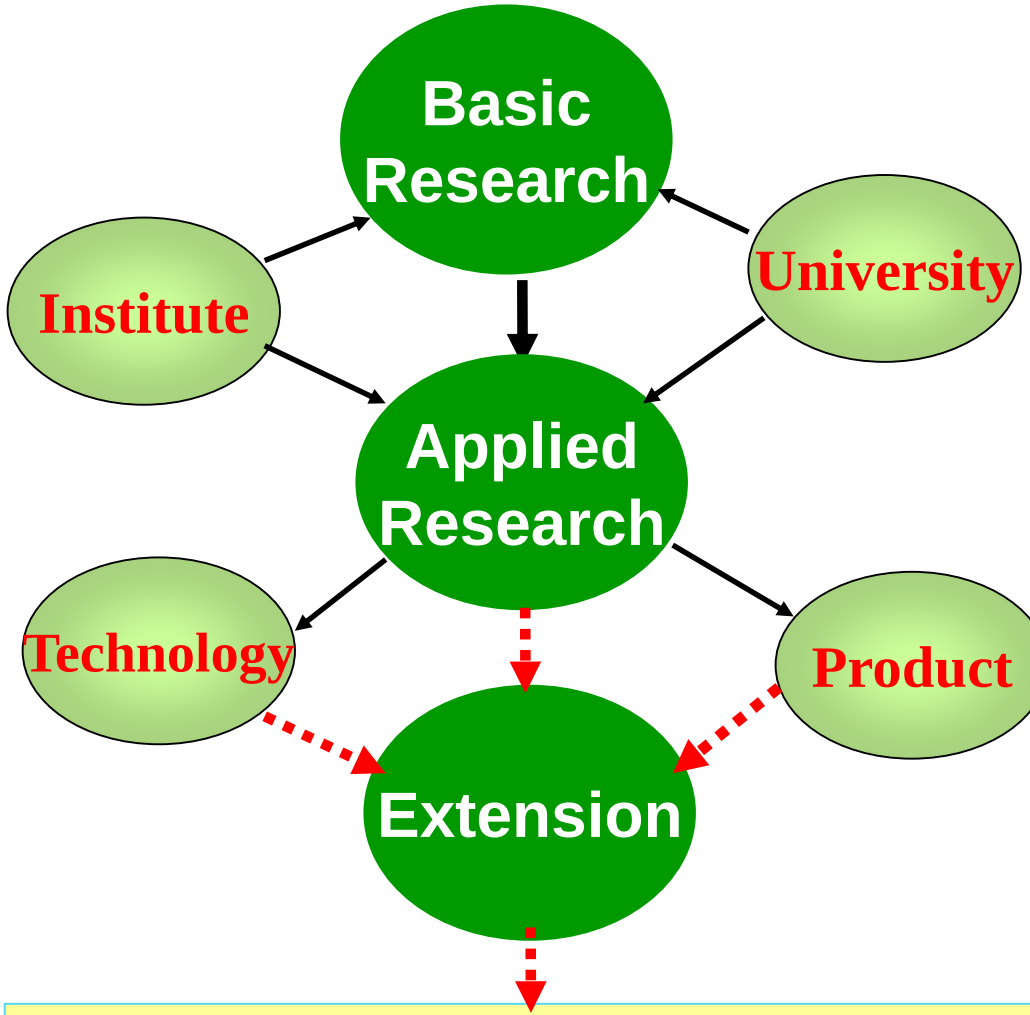
Main Methods of Extension System

Government-oriented extension

Farmer's demond-oriented extension

Extension

Gap between Research-Extension



How to bridge the gap between the research technology or products and farmers???

↓

Reasonable Extension System!!!

Projects for Research on Plant Health

- National Natural Science Foundation
- National Key Research and Development Program from MOST (2015-)
- Modern Agro-Industry Technology Research System from MARA
- Projects from Provincial Government

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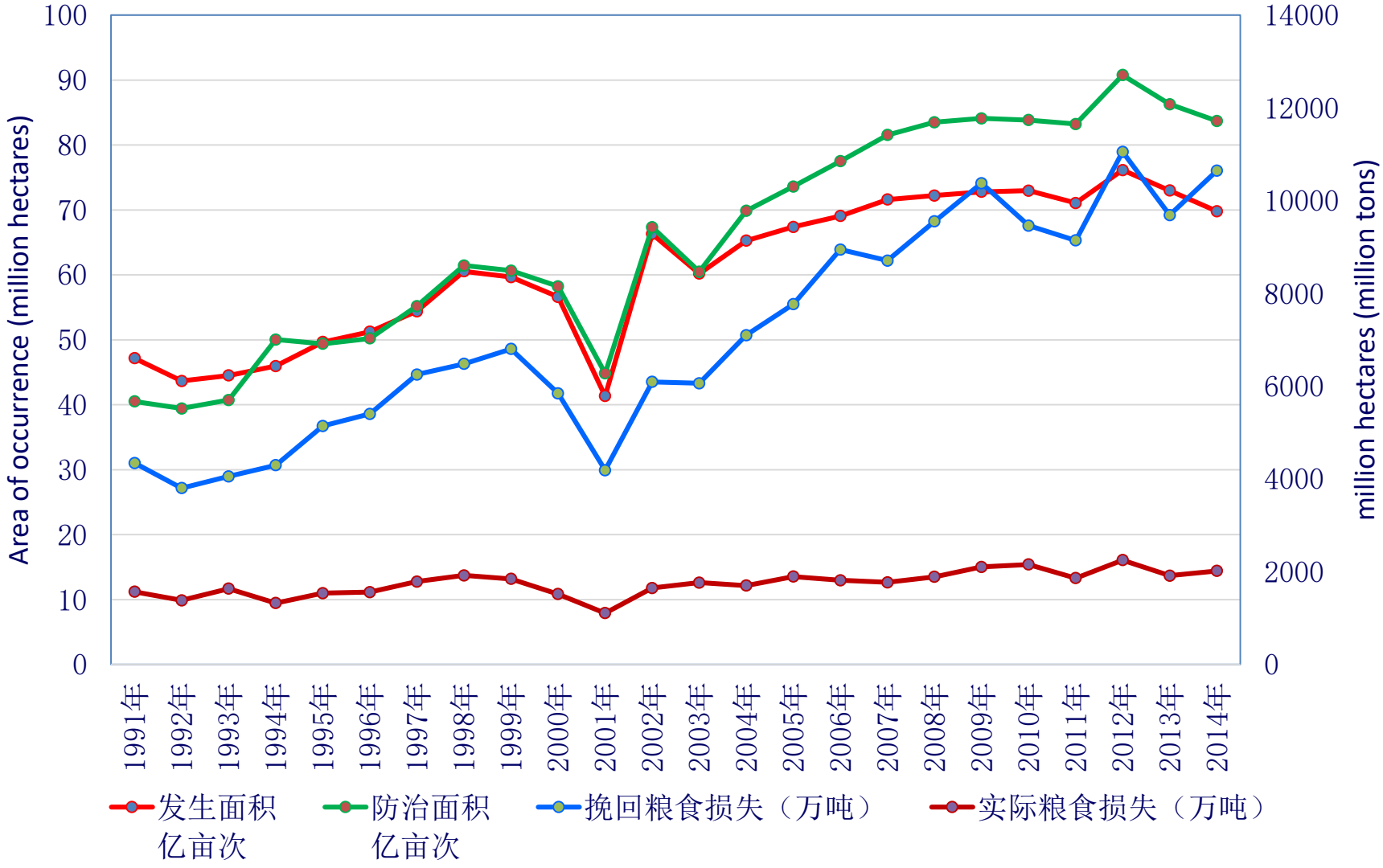
Statistics table of crop pests and rodents occurrence and damage



National Strategic Planning

- Green prevention and control: **cover rate would be more than 30%, which is increased by 10% 2014;**
- Unified prevention and control: **cover rate would be more than 40%, which is increased by 10% than 2014;**
- Scientific Application: **Utilizing rate of chemical pesticides would be more than 40%, which is increased by 5% than 2013.**

农 业 部 文 件

农农发〔2015〕2 号

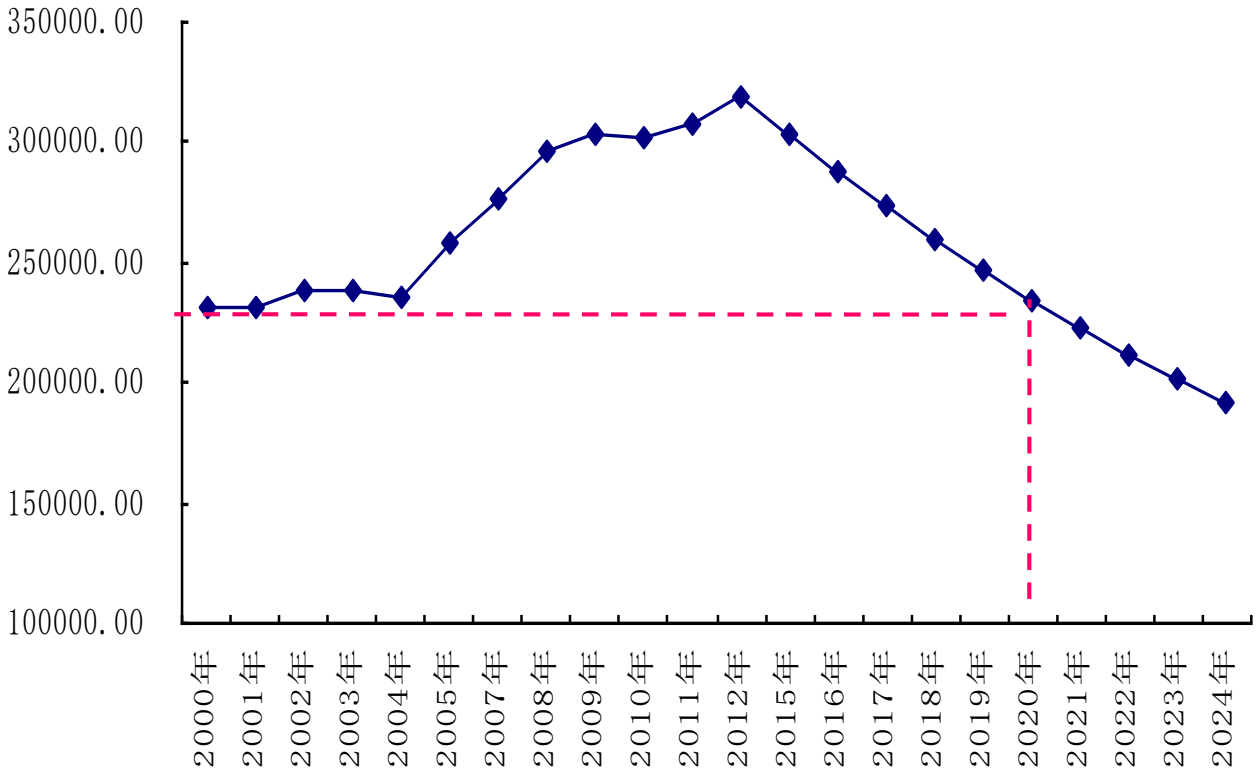
农业部关于印发《到 2020 年化肥使用量零增长行动方案》和《到 2020 年农药使用量零增长行动方案》的通知

各省、自治区、直辖市和计划单列市农业（农牧、农村经济）厅（委、局），新疆生产建设兵团农业局，黑龙江省农垦总局：

为贯彻落实中央农村工作会议、中央 1 号文件和全国农业工作会议精神，紧紧围绕“稳粮增收调结构，提质增效转方式”的工作主线，大力推进化肥减量提效、农药减量控害，积极探索产出高

By 2020, zero growth of pesticides

Ideas and Goals



- Reduce 15000 T per year
- Decreased to the level of the beginning of the century, by the year 2020

Technical Measures

- **Control: control crop diseases and insect pests**

  Control the disease and pest initial population number

  Control the using frequency: no harmful impact even though disease and pest occurred

- **Replace: replace High-toxic pesticides and inefficient spray tools**

  Develop low toxicity and risk pesticide

  Increase the atomization and subsidence, preventing the issues like serious escape and leakage.

- **Precise: implementation of precision pesticide application**

  Precision pesticide application to targets

  Pesticide application symptomatic timely and appropriate

- **Unified: promotion of unified prevention and control**

  Provide specialized service to resolve the serious confusion and difficulties of pesticide application

Promoting green prevention and control

- Established 218 national green prevention and control demonstration areas;
- Vigorously promoting ecological compatible and environment-friendly control strategies, including ecological control, behavioral manipulation, biological control, physical control and scientific application of pesticide, and the effect is pronounced.

Cultivation techniques

Crop rotation

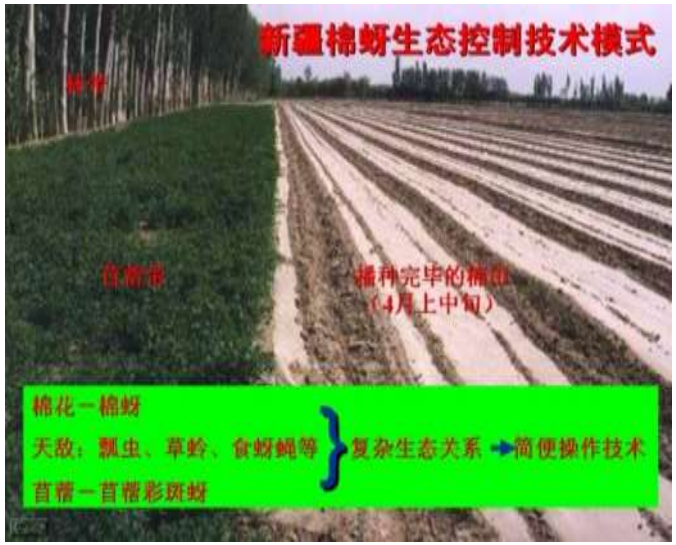
Deep ploughing

Pest net

Clean the pastoral

Ecological engineering- increase biodiversity

Increase biodiversity



Use push plant

Use bio-pesticides- virus, fungi, bacteria

Use natural enemies-release

Natural enemy insect products : more than 20 species

Application area more than 5 million mu

Use natural enemies-protect

Use insect pheromones

Use light trap and sticky trap

Use other non-chemical control measures

Trapping crop

Trapping plants

Light traps

Resistant varieties plus organic fertilizers

Raising ducks


Thank you!