

农业机械化与农业可持续发展

Agricultural Mechanization and Agricultural Sustainable Development

Presentation by

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CSAM



目录 Content

- ◆ **中国传统农耕文化历史悠久**
Chinese traditional farming culture has a long history
- ◆ **中国农业进入“调结构、转方式”历史时期**
Chinese agriculture has entered a period of ‘structure adjustment and pattern transformation’
- ◆ **治理面源污染开展的工作**
Works on non-point source pollution control and management
- ◆ **机械化技术供给与可持续发展的问题**
Problems of mechanization technology supply and sustainable development
- ◆ **推进农业可持续发展的下一步工作**
Future works for the promotion of agricultural sustainable development

一、中国传统农耕文化历史悠久

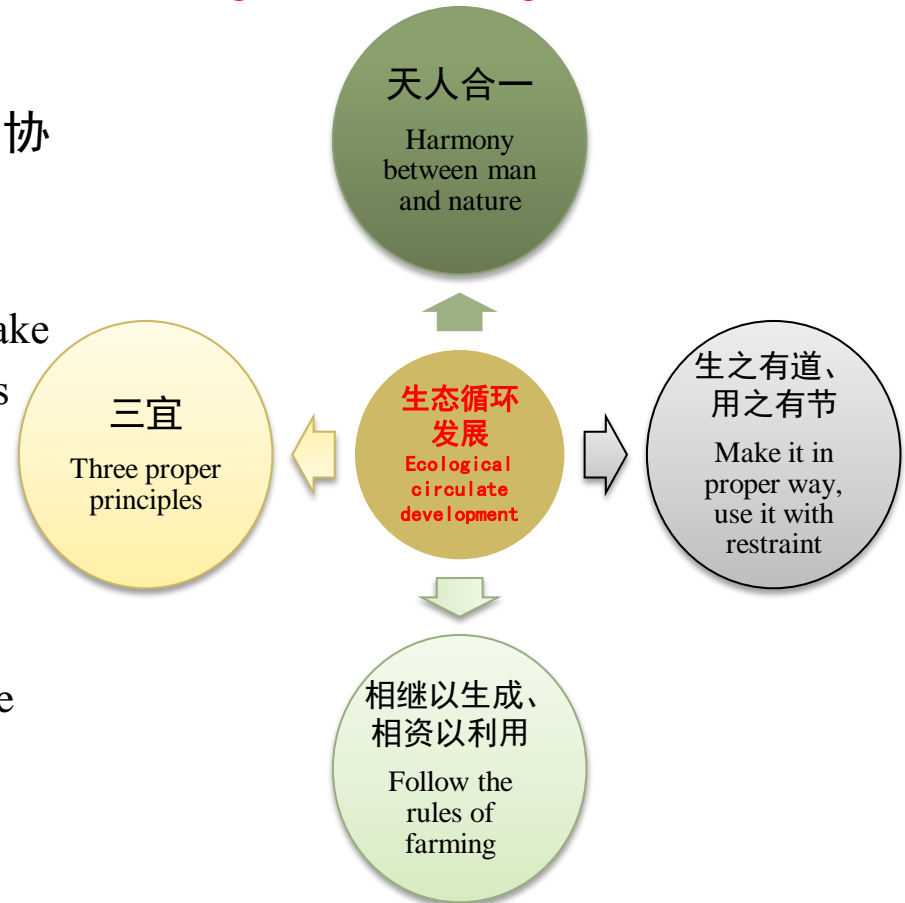
I . Chinese traditional farming culture has a long history

农业可持续发展是农耕文化精髓的历史传承

Agricultural sustainable development is the historical heritage of the farming culture essence

- **生态循环发展理念**：强调人与自然是协调而非对抗的，具有鲜明的**可持续发展**色彩。

Chinese ancient development concepts of ecological cycle such as ‘Harmony between man and nature’, ‘Make it in proper way, use it with restraint’, ‘Follow the rules of farming’, ‘Three proper principles’, emphasize the harmony, rather than confrontation, between man and nature, and form the awareness of natural cycle and allelopathy based on the understanding of the inner connection of agricultural system elements, which have the distinct characteristic of sustainable development.



一、中国传统农耕文化历史悠久

I. Chinese traditional farming culture has a long history

- **三宜**：因时、因地、因物制宜，强调尊重自然规律，重视人类主观能动性。

‘Three proper principles’ means the adaptation to the actual situation in terms of time, locality and the object oriented, which emphasizes respect for the laws of nature and puts a high value on the human subjective initiative.



一、中国传统农耕文化历史悠久

I. Chinese traditional farming culture has a long history



西周时代 (约前11世纪-771)

Western Zhou Dynasty (about 11C-771 B.C.)

- 使用绿肥和人畜粪肥及其他农家肥
- Application of green manure and other farmyard manures



东汉 (25年-220年)

Eastern Han Dynasty (25-220)

- 稻田中养鱼
- Farming fish in rice fields



宋代 (960年-1279年)

Song Dynasty (960-1279)

- 利用步行虫防治粘虫
- Ground beetle was used to control armyworm

春秋战国 (前770-221)

Spring and Autumn Period (770-221 B.C.)

- 施肥“可以美疆土”和“多粪肥田”
- Fertilizers can enhance soil fertility

西晋 (265年-316年)

Western Jin Dynasty (265-316)

- 蚂蚁防治柑橘害虫，这是世界上以虫治虫的最早记载
- Ant control citrus pests, which is the world's earliest records on 'pest control with pest'

清代 (1644年-1911年)

Qing Dynasty (1644-1911)

- 以螳螂防治菊花害虫
- Cockroach was used to control chrysanthemum pests

二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of 'structure adjustment and pattern transformation'

中国农业经过多年高速发展，进入新的发展阶段，也面临着一系列问题

Chinese agriculture has entered a new stage after years of rapid development, while it is still faced with a series of challenges.

2.1 农业资源利用方式不合理

2.1 The way of agricultural resource utilization is not reasonable

- **土地资源利用**：大部分农户只用不养，不施用有机肥与绿肥，掠夺性经营。
Land resources utilization: Land has been predatorily managed by most farmers with seldom application of organic fertilizer and green manure.
- **水资源利用**：农业用水有效利用率只有50%，大水漫灌、超量灌溉等现象普遍。
Water resources utilization: Agricultural water use efficiency is only about 50%. Flood irrigation and excessive irrigation is quite common.
- **生物资源利用**：近海过度捕捞和内陆渔业资源过度利用，野生动植物资源多样性面临威胁。
Bio-resource utilization: Over-fishing in offshore areas and over-use of inland fishery resources is becoming serious problems. The diversity of wild animal and plant resources is under threat.

二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of 'structure adjustment and pattern transformation'

2.2 农业生产资料利用效率不高

2.2 Use efficiency of agricultural production resources is not high

➤ **化肥**：我国化肥施用量全球第一。

Fertilizer: The chemical fertilizers consumption in China ranks the first around the world

我国亩均化肥用量：21.2kg

世界亩均化肥平均用量：8kg

Average fertilizer quantity in China: 318kg/ha

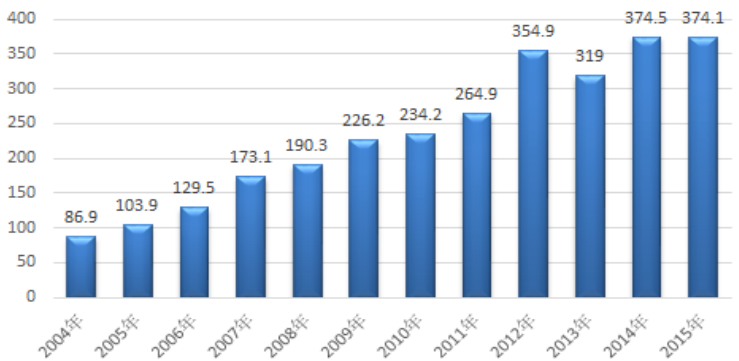
World's average level: 120kg/ha

我国化肥当季利用率：30%

发达国家化肥当季利用率：50%

Fertilizer use efficiency in China: 30%

Fertilizer use efficiency in developed countries: 50%



我国农药历年产量（万吨）
Pesticide production in recent years in China
(10 thousand tons)

➤ **农药**：我国是世界农药生产和使用第一大国，每年用量约30万t（利用率仅35%）。

Pesticide: China is the largest pesticides production and consumption country in the world. About 300,000t pesticides are applied every year (use efficiency is only about 35%)

二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of 'structure adjustment and pattern transformation'

- **农膜**：每年约有50万吨农膜残留于土壤，残留率40%。

Agricultural plastic film: there is about 500,000t plastic film remain in the soil each year and residual rate has attached 40%.

- **农机**：超过报废年限仍在使用的农业机械约占30%，小型机械占50%，造成了能耗高、污染大、安全隐患严重等问题。

Agricultural machine: about 30% large and medium-sized tractors and 50% small-sized tractors that used more than 10 years and over the retirement life were still in use, which resulted in high consumption, severe pollution and serious potential safety risks.

- **渔船**：渔船老化、设备陈旧、能耗高，油耗占捕捞成本60%-70%，是发达国家3倍多。

Fisher: aging fishers, outdated equipment and higher energy consumption lead to high cost of fishing, especially fuel consumption occupied more than 60%~70% of the fishing cost, which is triple of that in developed countries.

二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of 'structure adjustment and pattern transformation'

2.3 农业面源污染比较突出

2.3 Agricultural non-point source pollution is prominent

- 由于化肥、农药、农膜等不合理使用，加之规模养殖比重迅速提高、种养未能有效结合，**农业面源污染问题日益突出。**

The irrational utilization of fertilizers, pesticides, plastic film and other agricultural inputs, the increasing portion of large scale farming and the inefficient combination of planting and breeding, cause the prominent problem of agricultural non-point source pollution.

- 我国每年约产生**38亿吨**畜禽粪污，有效处理率仅**42%**，传统农家肥变成了水环境的主要污染物。

About 3.8 billion tons of livestock and poultry manure are produced in China each year. With low effective utilization and treatment (42%) the traditional farm manure has become the main pollutant in water environment.

- 2013年全国秸秆可收集利用量8.19亿t，实际利用量约6.22亿t，综合利用率**76%**。

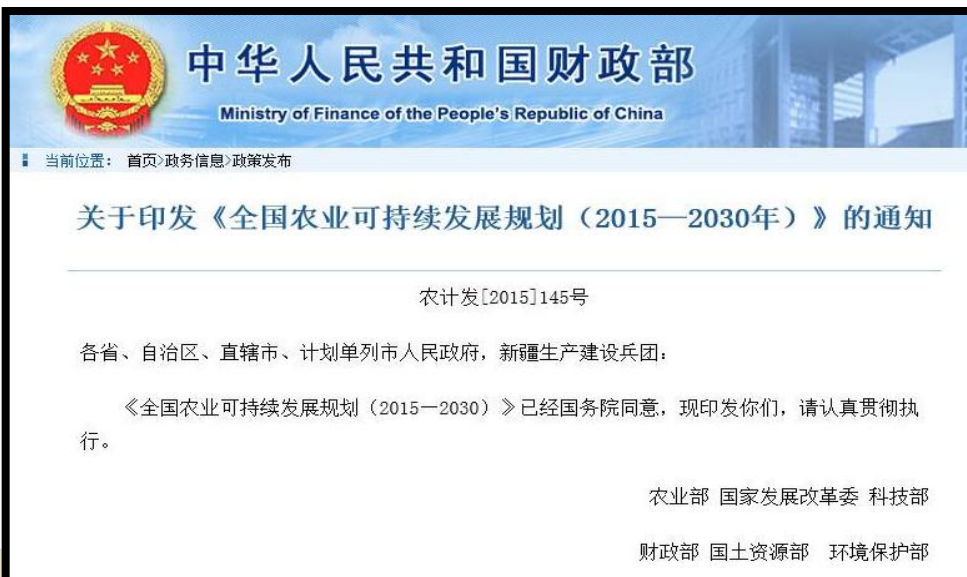
In 2013, the crop straw that can be collected for use is 819 million tons. However, about 622 million tons were utilized; the comprehensive utilization rate was only 76%.

二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of ‘structure adjustment and pattern transformation’

面对以上问题，农业部等多部委共同制订《全国农业可持续发展规划（2015-2030年）》，并提出农业面源污染防控“一控两减三基本”目标任务。

Facing these problems, Ministry of Agriculture of the People’s Republic of China and other ministries jointly formulated the "The Plan for agricultural sustainable development (2015-2030)", and put forward the objective and task which can be concluded as ‘one regulatory, two reductions, three basics’ to control agricultural non-point source pollution.



中华人民共和国财政部
Ministry of Finance of the People's Republic of China

当前位置: 首页 > 政务信息 > 政策发布

关于印发《全国农业可持续发展规划（2015—2030年）》的通知

农计发[2015]145号

各省、自治区、直辖市、计划单列市人民政府，新疆生产建设兵团：

《全国农业可持续发展规划（2015—2030）》已经国务院同意，现印发你们，请认真贯彻执行。

农业部 国家发展改革委 科技部
财政部 国土资源部 环境保护部
水利部 国家林业局

The Plan for agricultural sustainable development



二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of ‘structure adjustment and pattern transformation’

➤ 一控：严格控制农业用水总量，大力发展节水农业

One regulatory: Strictly control the total amount of agricultural water and strive to develop water-saving agriculture

目标：农业灌溉用水量保持在3720亿m³

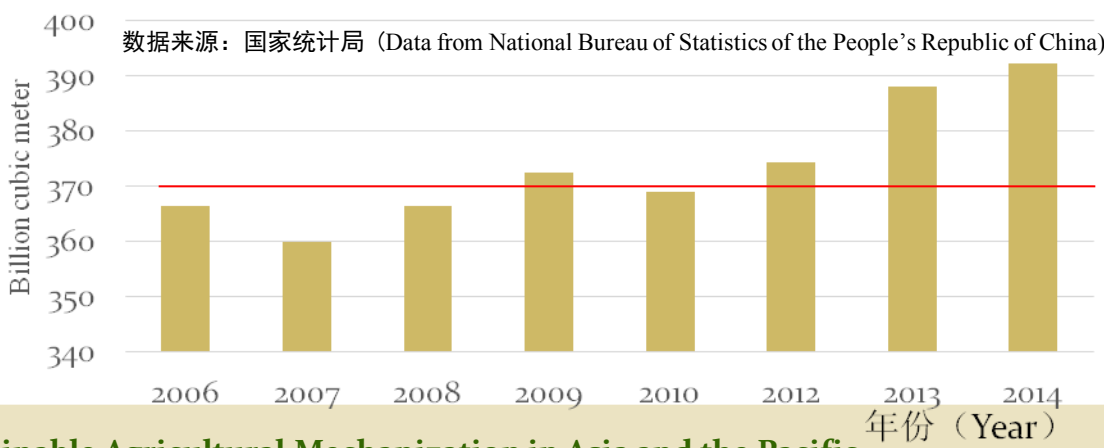
Objective: Limit the agricultural irrigation water to 372 billion cubic meters.

农田灌溉水有效利用系数达到0.55

Increase the effective utilization rate of irrigation water to 0.55.



我国历年农业用水总量
The total amount of agricultural water in China



二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of 'structure adjustment and pattern transformation'

➤ 两减：减少化肥和农药使用量

Two reductions: Reduce the use of fertilizer and pesticide

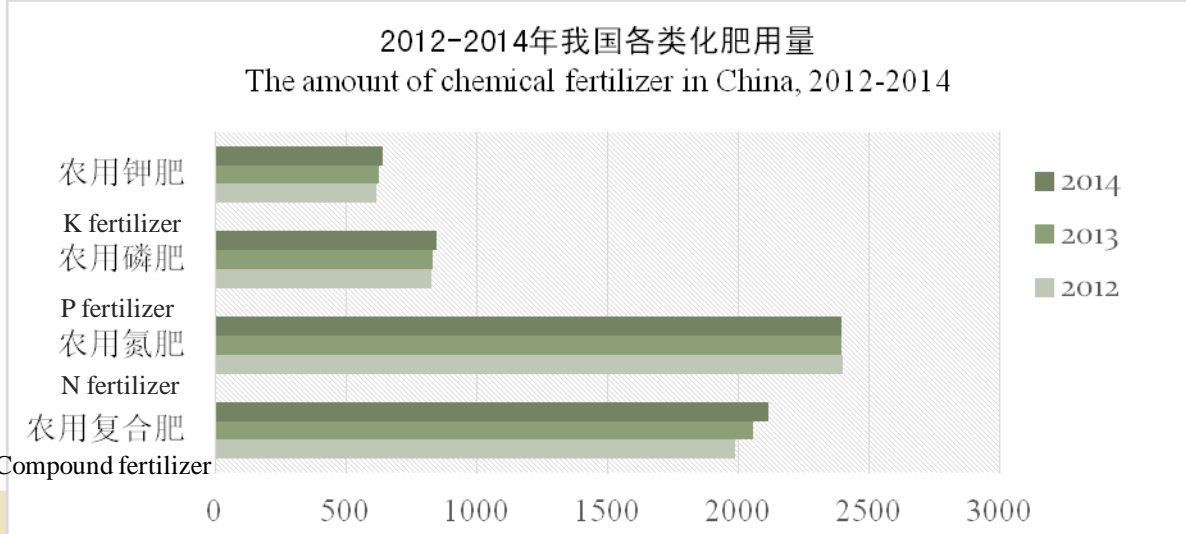
目标：确保测土配方施肥技术覆盖率 $\geq 90\%$ ，全国主要农作物化肥、农药使用量实现零增长

Objective: Use rate of soil testing and formulated fertilization technology $\geq 90\%$; zero growth of chemical fertilizers and pesticides use quantity.

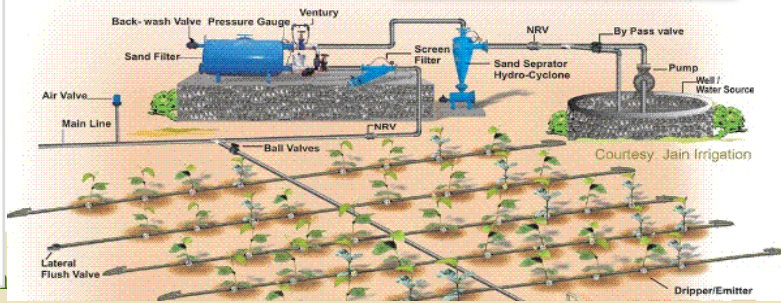
农作物病虫害绿色防控覆盖率 $\geq 30\%$

Use rate of green prevention and control of crop pest technology $\geq 30\%$

肥料、农药利用率 $\geq 40\%$ Fertilizer and pesticide use efficiency $\geq 40\%$



数据来源：国家统计局 (Data from National Bureau of Statistics of the People's Republic of China)



二、中国农业进入“调结构、转方式”历史时期

II. Chinese agriculture has entered a period of 'structure adjustment and pattern transformation'

➤ **三基本**：畜禽粪便、农作物秸秆、农膜基本资源化利用，推进农业废弃物的回收利用

Three basics: Preliminary resource utilization of the livestock and poultry manure, crop straw and agricultural films; vigorously promote the recycling of agricultural waste

目标：确保规模畜禽养殖配套建设**废弃物处理设施比例** $\geq 75\%$

Objective: More than 75% of the intensive livestock farming equip with waste water treatment facilities.

秸秆综合利用率 $\geq 85\%$

More than 85% usage rate of straw comprehensive utilization

农膜回收率 $\geq 80\%$

More than 80% recovery rate of plastic film



三、治理面源污染开展的工作

III. Works on non-point source pollution control and management

3.1 制定《农业面源污染防治工作重点》

3.1 Planned Focus on Agricultural Non-point Source Pollution Prevention and Control



您现在的位置 首页

农业部关于打好农业面源污染防治攻坚战的意见

日期：2015-04-13 17:24 作者：来源：农业部新闻办公室

农科教发〔2015〕1号

各省、自治区、直辖市及计划单列市农业（农牧、农村经济）、农机、畜牧、兽医、农垦、农产品加工、渔业厅（局、委、办），新疆生产建设兵团农业局：

加强农业面源污染治理，是转变农业发展方式、推进现代农业建设、实现农业可持续发展的重要任务。习近平总书记指出，农业发展不仅要杜绝生态环境欠新账，而且要逐步还旧账，要打好农业面源污染治理攻坚战。李克强总理提出，要坚决把资源环境恶化势头压下来，让透支的资源环境得到休养生息。2015年中央1号文件对“加强农业生态治理”作出专门部署，强调要加强农业面源污染治理。今年政府工作报告也提出了加强农业面源污染治理的重大任务。为贯彻落实好党中央、国务院一系列部署要求，坚决打好农业面源污染防治攻坚战，加快推进农业生态文明建

一、打好农业面源污染防治攻坚战总体要求

（一）深刻认识打好农业面源污染防治攻坚战的重要意义。农业资源环境是农业生产的物质基础，也是农产品质量安全的源头保障。随着人口增长、膳食结构升级和城镇化不断推进，我国农产品需求持续刚性增长，对保护农业资源环境提出了更高要求。目前，我国农业资源环境遭受着外源性污染和内源性污染的双重压力，已成为制约农业健康发展的瓶颈约束。一方面，工业和城市污染向农业农村转移排放，农产品产地环境质量令人堪忧；另一方面，化肥、农药等农业投入品过量使用，畜禽粪便、农作物秸秆和农田残膜等农业废弃物不合理处置，导致农业面源污染日益严重，加剧了土壤和水体污染风险。打好农业面源污染防治攻坚战，确保农产品产地环境安全，是实现我国粮食安全和农产品质量安全的现实需要，是促进农业资源永续利用、改善农业生态环境、实现农业可持续发展的

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三、治理面源污染开展的工作

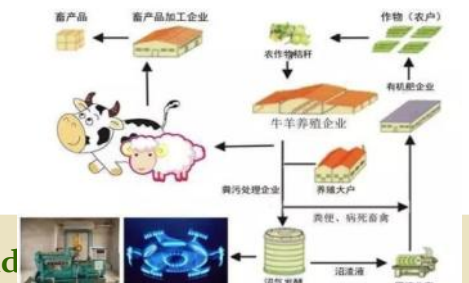
III. Works on non-point source pollution control and management

3.2 开展科学研究

3.2 Scientific research has been carried out

设立科研项目，开展秸秆还田、水浇地耕层构建、残膜回收、西北旱作种植技术、化肥农药减施、畜禽废弃物处理等技术研究。

The scientific projects were set up to study the technologies of straw returning, construction of irrigable land cultivated layer, collection of residue plastic film, farming in dry lands of Northwest China, fertilizer and pesticide reduction, livestock and poultry waste treatment, etc.



三、治理面源污染开展的工作

III. Works on non-point source pollution control and management

3.3 启动了一批重点项目

3.3 Launched a batch of key projects

围绕面源污染综合治理、秸秆综合利用、生态循环农业、畜禽粪污治理等，整合资金近40亿元，启动了一批重点项目。

These projects focused on comprehensive management of the non-point source pollution, comprehensive utilization of straw, ecological circular agriculture and livestock and poultry waste treatment, which integrated nearly 4 billion yuan.

①启动农业环境突出问题治理项目

Launched the projects related to solving the agricultural environment prominent problems.

启动典型流域农业面源污染综合治理、农牧交错带已垦草原治理、东北黑土地保护三类项目。

Three kinds of projects (comprehensive management of agricultural non-point resource pollution in typical watershed area, management of cultivated grassland in the farming pastoral ecotone, protection of black soil in Northeast China) were set up.



东北黑土地 “一年退化一厘米”

三、治理面源污染开展的工作

III. Works on non-point source pollution control and management

②启动农作物秸秆综合利用项目，保护和提升耕地质量

The projects of comprehensive utilization of crop straw were launched to protect and enhance farmland quality.



直接还田
Return to field



制备生物有机肥
Produce bio-organic fertilizer



发电与燃气
Electricity and gas



建筑材料
Building material

三、治理面源污染开展的工作

III. Works on non-point source pollution control and management

③实施区域生态循环农业示范项目

Regional ecological circular agriculture demonstration projects were implemented.

开展生态农业示范、养殖废弃物资源化利用、秸秆综合利用、农副资源饲料化利用、稻渔共生综合种养等示范。

Carried out some demonstration projects related to ecological agriculture, recycling utilization of cultivation waste, comprehensive utilization of straw, feed processing utilization of agricultural sideline resource, rice-fish symbiotic integrated farming, etc.



三、治理面源污染开展的工作

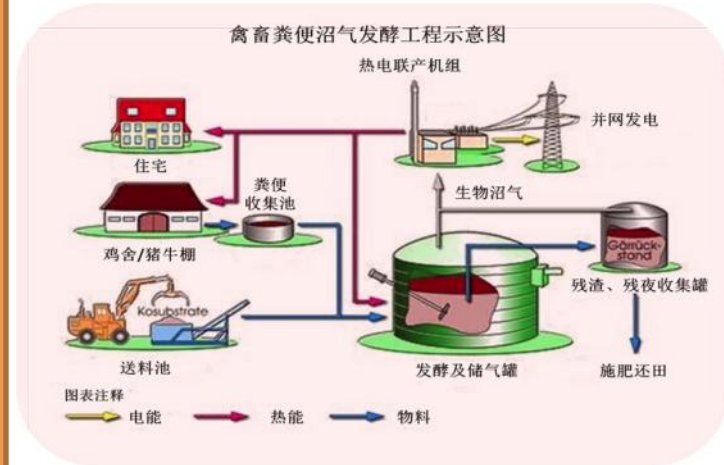
III. Works on non-point source pollution control and management

④实施畜禽粪污综合利用试点项目

Pilot projects on comprehensive utilization of livestock and poultry waste were implemented.

通过政府购买服务等方式，支持社会化服务组织开展畜禽粪污储存、收运、处理、利用等。

The social service organizations were supported to conduct the works on storage, transportation, processing and utilization of livestock and poultry waste through government-purchasing services.



Livestock
faces



Fermentation

Generate electricity



Return to field

三、治理面源污染开展的工作

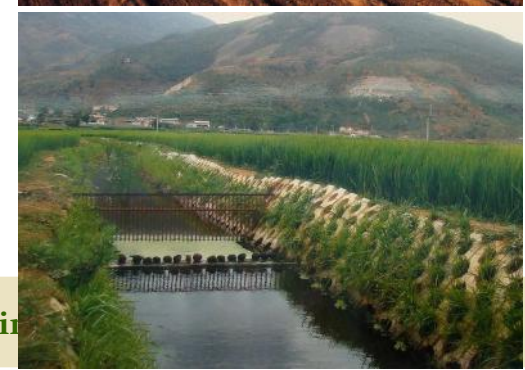
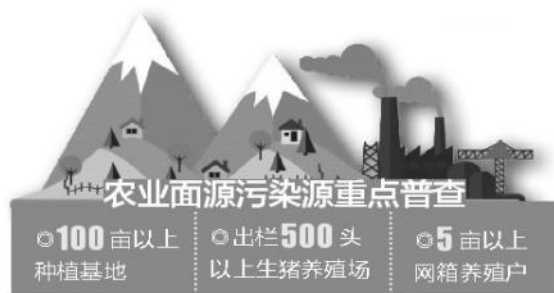
III. Works on non-point source pollution control and management

3.4 建设了一批试点示范工程

3.4 Set up a batch of demonstration projects

在全国启动建设一批示范样板，集成关键技术，总结试点经验，推广成熟模式。

A batch of demonstration prototype was set up to integrate key technology, summarize experience and promote maturity mode.



四、机械化技术供给与可持续发展的问题

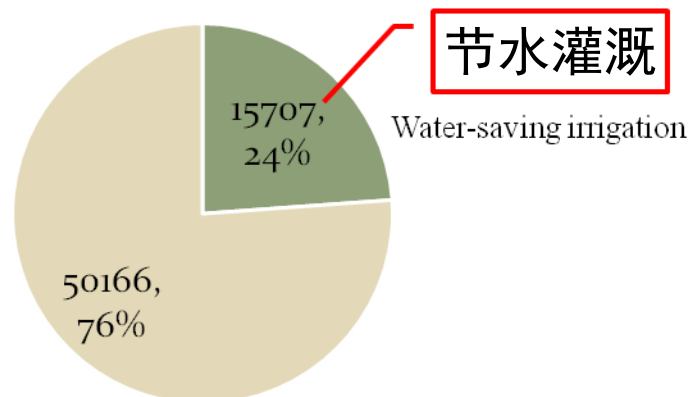
IV. Problems of mechanization technology supply and sustainable development

4.1 节水灌溉

4.1 Water-saving

- **节水灌溉面积小。** 2015年耕地灌溉面积65873万公顷，节水灌溉只有15707万公顷（24%）。The area of Water-saving irrigation is low. In 2015, the area of irrigated farmland was 658.73Mha, while the area of water-saving irrigation was only 157.07Mha (accounts for 24%).

2015年耕地灌溉占比
Proportion of each irrigation in China



- **节水灌溉与耕作方式匹配不合理**，不合理耕作依然存在。北方旱作农区，由于长期采用喷滴灌、微灌出现土壤盐渍化，生态修复困难。

Water-saving irrigation technology does not match tillage method, and unreasonable tillage practice still exists. Long-term spray-irrigation and micro-irrigation caused soil salinization in dryland areas of northern China, and the ecological restoration in these areas was difficult.



四、机械化技术供给与可持续发展的问题

IV. Problems of mechanization technology supply and sustainable development

4.2 化肥施用

4.2 Application of chemical fertilizer

大部分采用一次性施用。 中耕施肥机具、精量施肥机具少。畜禽粪污处理后，有机肥撒施、以及液态施用难，农民怕脏怕累不愿意施用。

Most fertilizing adopts one-time using of fertilizers. There are short in cultivator and precision fertilization machine. After the procession of livestock and poultry waste, the organic and liquid fertilizers are difficult to be used by machines, and the farmers do not want to use these fertilizers due to dirty and hard works.

4.3 农药施用

4.3 Application of pesticide

人工背负式机具多，自走式、航空机具少。

There are more artificial knapsack machine and less self-propelled machine or air tools.



四、机械化技术供给与可持续发展的问题

IV. Problems of mechanization technology supply and sustainable development

4.4 耕作

4.4 Tillage

保护性耕作面积比例低。 2015年有9468千公顷，占耕地面积不足8%。全国大部分地区普遍旋耕，技术普及不到位，没有形成科学合理的可持续发展的土壤耕作制度。

The adoption areas of conservation tillage is low, and only accounted for <8% (9.468Mha) of national arable lands by the end of 2015. Roto-till is popular in most areas, and there are no scientific and reasonable soil tillage system for sustainable development.

4.5 农膜

4.5 Plastic film

捡拾困难。 一是种植模式影响；二是农膜厚度与强度不够；三是技术与机具缺乏。

It is difficult to collect residue plastic film due to (1) The impacts of cropping pattern; (2) Insufficient thickness and intension of plastic film; (3) Lacking technology and equipment.



五、推进农业可持续发展的下一步工作

V. Future works for the promotion of agricultural sustainable development

5.1 推进现代土壤耕作技术进步

5.1 Promote the development of modern tillage technology

基于保护性耕作，围绕秸秆还田和土壤耕层“浅实少”、有机质分布不均等问题，研究提出不同区域、不同土壤类型，适应不同种植结构的合理耕作方式。

On the basis of conservation tillage, reasonable tillage methods for different regions, soil types and planting structures should be studied and put forward to solve uneven distribution of soil organic matter and tillage layer's problems of 'shallow, compaction and less fertility'.

Conservation tillage



Soil compaction



五、推进农业可持续发展的下一步工作

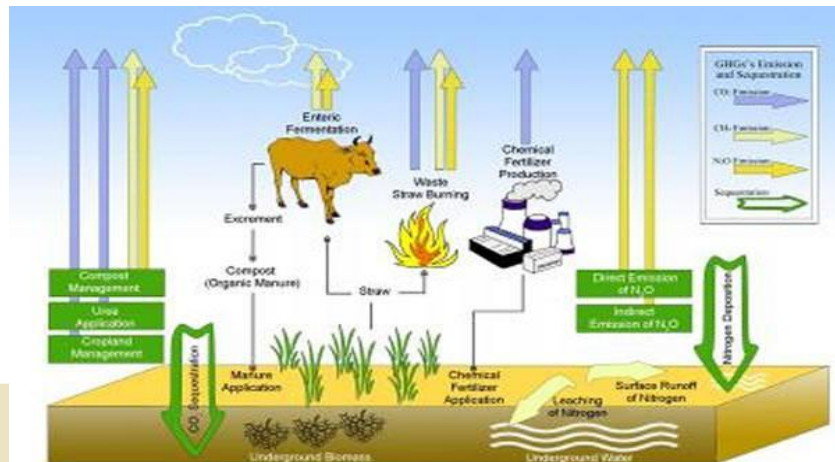
V. Future works for the promotion of agricultural sustainable development

5.2 推进种养循环，开展水果蔬菜茶叶有机肥沼肥替代化肥行动

5.2 Promote planting and breeding cycle technology, and carry out the action that replaces chemical fertilizer with organic and biogas fertilizers in fruit, vegetable and tea production

重点在畜牧业重点养殖区，选择100个县开展试验示范，熟化技术模式，筛选优化机具，解决好有机肥施用最后1公里问题。

Mainly in animal husbandry zones, 100 counties are selected for experiment and demonstration. In these counties, the last ‘one kilometer’ problem for organic manure application will be solved by maturing technical modes and optimizing machines.



五、推进农业可持续发展的下一步工作

V. Future works for the promotion of agricultural sustainable development

5.3 推进化肥农药精准施用，加快田间管理阶段水肥药一体化施用

5.3 Promote the precision application of chemical fertilizer and pesticide; improve machine performance; strengthen control effect; speed up the integrated application of water fertilizer and pesticide during field management stage



五、推进农业可持续发展的下一步工作

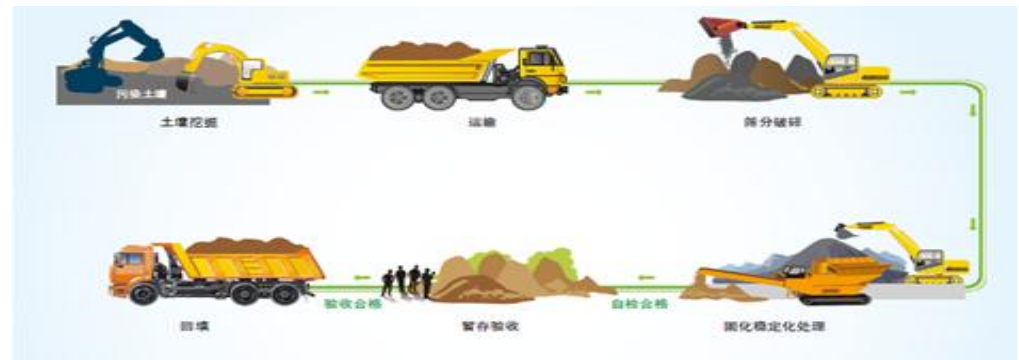
V. Future works for the promotion of agricultural sustainable development

5.5 推进面源污染治理

5.5 Promote the control and management of non-point source pollution

加快旱作农业地膜捡拾、土壤重金属污染治理机具研发，增加农民购买补贴。

Speed up the collection of agricultural plastic film in dryland farming and the development of soil heavy metal pollution control equipment; increase farmers' purchase subsidies.



五、推进农业可持续发展的下一步工作

V. Future works for the promotion of agricultural sustainable development

5.6 推进农机节能减排

5.6 Promote energy-saving and emission-reduction for agricultural machinery

开展老旧农机报废更新，合理匹配机器系统。研发小型电动农机具，利用太阳能开展节水灌溉等。

Carry out the old farm machinery to scrapped practice; optimize the agricultural production process; reasonably match machine; develop small electric equipment; apply solar energy for water saving irrigation.



谢谢！
Thank you.



CSAM

