Implementation of the Pilot Project on Integrated Straw Management in China

Dr. He Jin, Professor

China Institute for Conservation Tillage ,China Agricultural University

Conservation Tillage Research Center, MARA, P. R. China

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

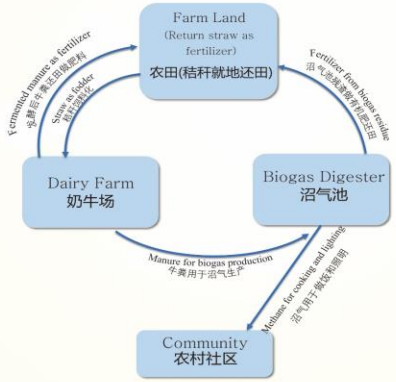
CSAM

CSAM Pilot Project on Integrated Straw Management in China
联合国可持续农业机械化中心秸秆综合利用中国试点项目

Project Period: 2018-2021
项目周期：2018-2021

Project Objectives:
1) to develop an innovative, circular and green model of integrated straw management for using straw residue as fertilizer, fodder and for green energy production; 2) to enhance awareness of farmers and other key stakeholders on technologies and models for integrated straw management; 3) to upscale the application of successful integrated straw management technologies and models.

项目目标：
1）总结一套创新、可循环、绿色秸秆综合利用模式，将秸秆用于肥料、饲料和绿色能源生产；2）提升当地农民及其他相关人员对试点秸秆综合利用模式的认识；3）推广试点秸秆综合利用模式的应用范围。



Technologies and models for pilot project
试点技术模式：

Returning straw to the field: straw chopping – straw mulching – decomposition of straw to serve as organic fertilizer.
秸秆还田：秸秆粉碎 – 秸秆覆盖 – 秸秆分解为有机肥

Fodder for cattle: collection of maize straw – straw composting and storage in ensilage digester – straw fermentation – mixing fermented straw with other ingredients – feeding cattle.
秸秆用于饲料：收集玉米秸秆 – 秸秆堆肥、存储于青贮窖 – 秸秆发酵 – 发酵秸秆与其他饲料混合为奶牛饲料

Returning cow manure to the field: collection of cow manure and composting – return of cow manure to field as organic fertilizer.
牛粪肥还田：收集牛粪并堆肥 – 发酵牛粪为有机肥还田

Producing biogas: collection of cow manure – manure fermentation in biogas digester – supplying biogas to farmers via pipes.
秸秆用于沼气生产：收集牛粪 – 牛粪沼气池发酵 – 沼气通过管道供给农民使用

Returning biogas residue to the field: production of organic fertilizer from biogas waste – returning of biogas waste to the field.
沼气池残渣还田：沼气池残渣生产有机肥 – 有机肥还田

Project Partners
Centre for Sustainable Agricultural Mechanization (ESCAP-CSAM)
China Agricultural University
Conservation Tillage Research Centre, Ministry of Agriculture and Rural Affairs, China
Qingdao Administration of Agriculture and Rural Affairs
Laixi Administration of Agriculture and Rural Affairs

Demonstration Site Partner (Laixi, Qingdao)
Qingdao Zhitao Agricultural Machinery Specialized Cooperative

项目单位
联合国可持续农业机械化中心
中国农业大学
中国农业农村部保护性耕作研究中心
青岛市农业农村局
莱西市农业农村局

示范点 (青岛-莱西)
青岛志涛农机专业合作社

SUSTAINABLE DEVELOPMENT GOALS

Thanks for the support of this project by Center for Sustainable Agricultural Mechanization (ESCAP-CSAM), Qingdao Administration of Agriculture and Rural Affairs, Laixi Administration of Agriculture and Rural Affairs

Project objective

Objective 1: **Develop** an integrated straw management

Objective 2: **Establish** demonstration site in Laixi

Objective 3: **Technical trainings** on integrated straw management technology

Demonstration site

During 2018 and 2022, the project was carried out with the support of CSAM and a pilot was established in Laixi, Qingdao.
The three main crops (Wheat, Maize and Peanut) annually produce >800 thousand tons of straws. It's a great challenge for Laixi!

Objective 1: Develop an integrated straw management

2. Fodder

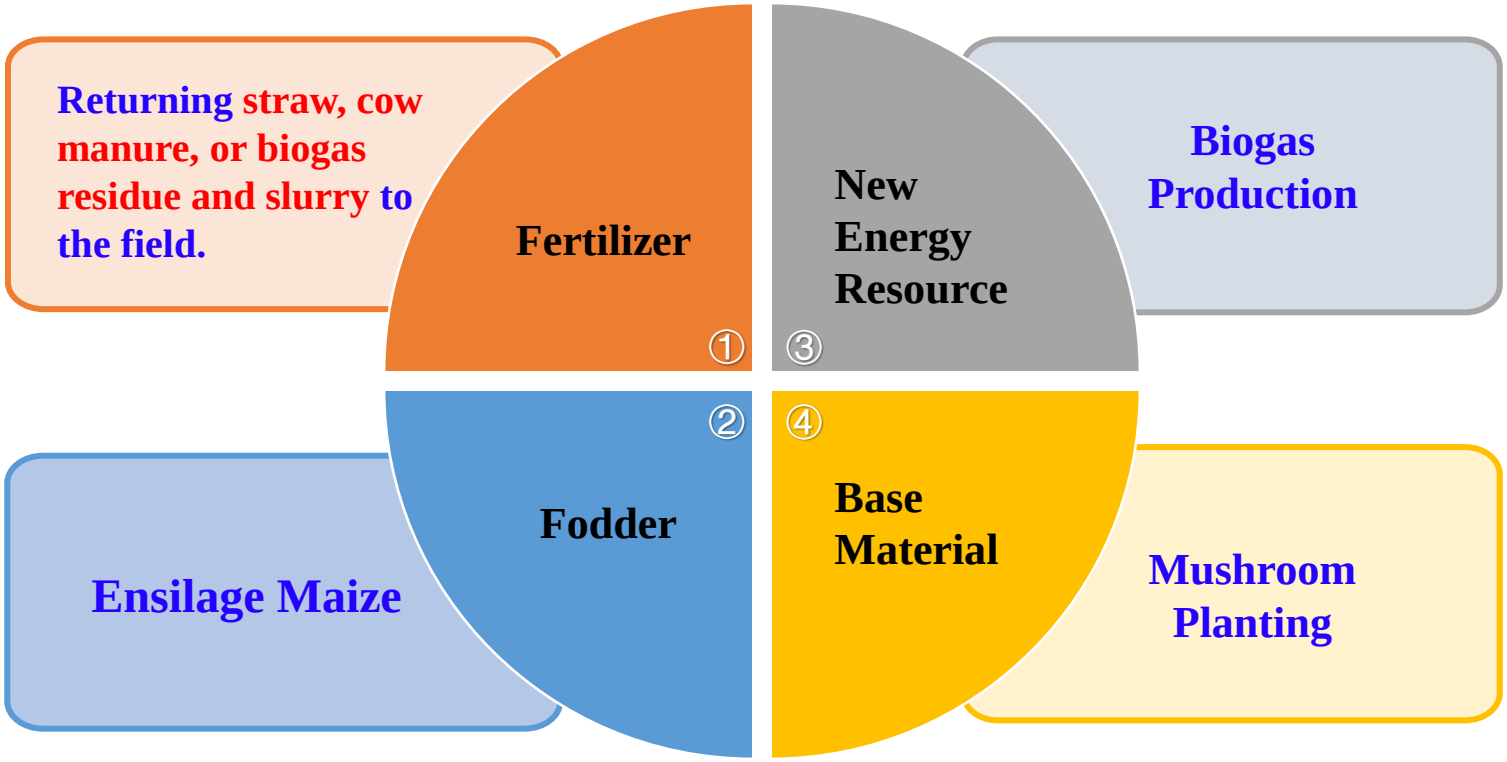
1. Fertilizer

Integrated Straw Management

3. New energy resources

4. Base material

Straw used as …



Fertilizer

① Returning straw to the field-*Straw cover*

Wheat harvesting and Straw chopping

No tillage seeding of maize

Maize harvesting and Straw chopping

No tillage seeding of wheat

Fertilizer

② Returning straw to the field-*Straw mixing with soils*

Wheat harvesting and Straw chopping

No tillage seeding of maize

Maize harvesting and Straw chopping

Maize straw mixing with soils

Wheat seeding

Improved technical mode of returning straw to the field

First year

Straw chopping

Second year

Straw chopping and mixing with soil

Third year

Improve maize no-till seeding quality

Fertilizer

③ Returning cow manure to the field

Maize ensilage harvesting

Feeding cows

Cow manure collecting and separation

Cow manure fermentation

Returning cow manure to the field

Mixing cow manure with soils

Wheat seeding

Improved technical mode of returning cow manure to the field

First year

Sewage disposal through cow manure

Second year

Addition of Dry-wet cow manure separation

Third year

Addition of plastic film cover fermentation and Ten-stage sedimentation tank

Fertilizer

④ Returning biogas residue and slurry to the field

Straw (cow manure) preparation

Pre-mixing

Biogas fermentation

Separation of biogas residue and slurry

Returning biogas slurry to the field

Mixing biogas slurry with soils

Wheat seeding

Improved technical mode of returning biogas residue and slurry to the field

Second year

Pre-mixing

Third year

Addition of dry-wet biogas slurry and biogas residue separation

Fodder

Ensilage Maize

Maize seeding

Maize ensilage harvesting

Straw fermentation

Processing fodder

Feeding cows

Milk production

Improved technical mode of Ensilage Maize

First year

Feeding cow

Second year

Addition of mechanized straw kneading

Third year

Addition of catalytic enzyme

New Energy Resources

Biogas Production

Straw preparation

Biogas fermentation and production

Processing

Biogas transportation

Usage

Base Material

Mushroom Cultivation

Base material preparation

Bagging

Sterilization

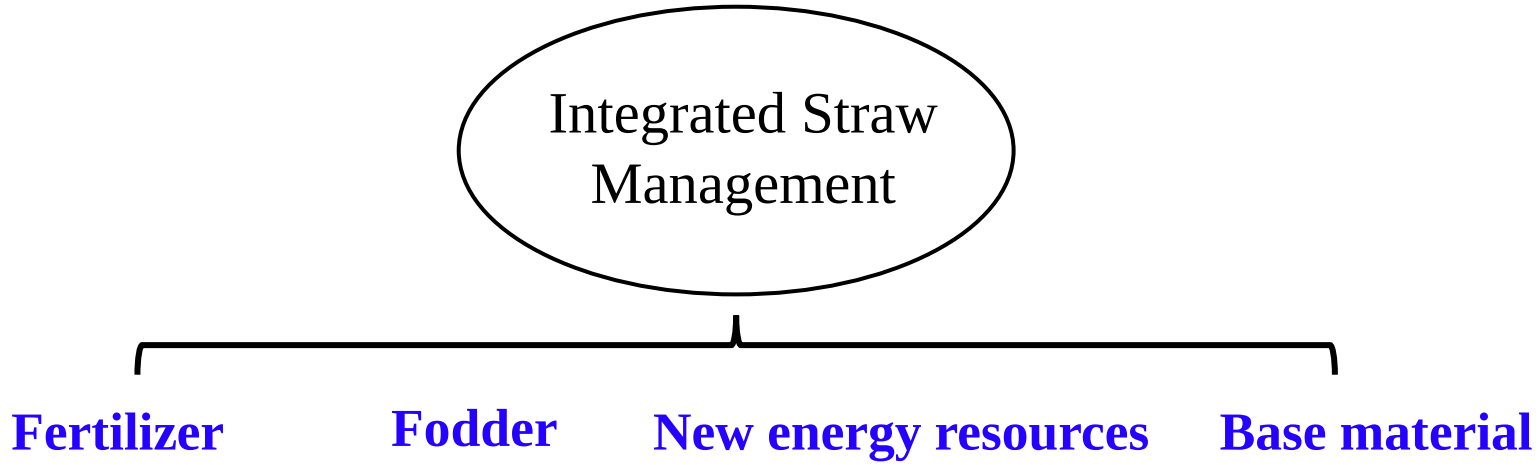
Mushroom inoculation

Mushroom cultivation

Harvesting

Objective 2: **Establish** demonstration site in Laixi

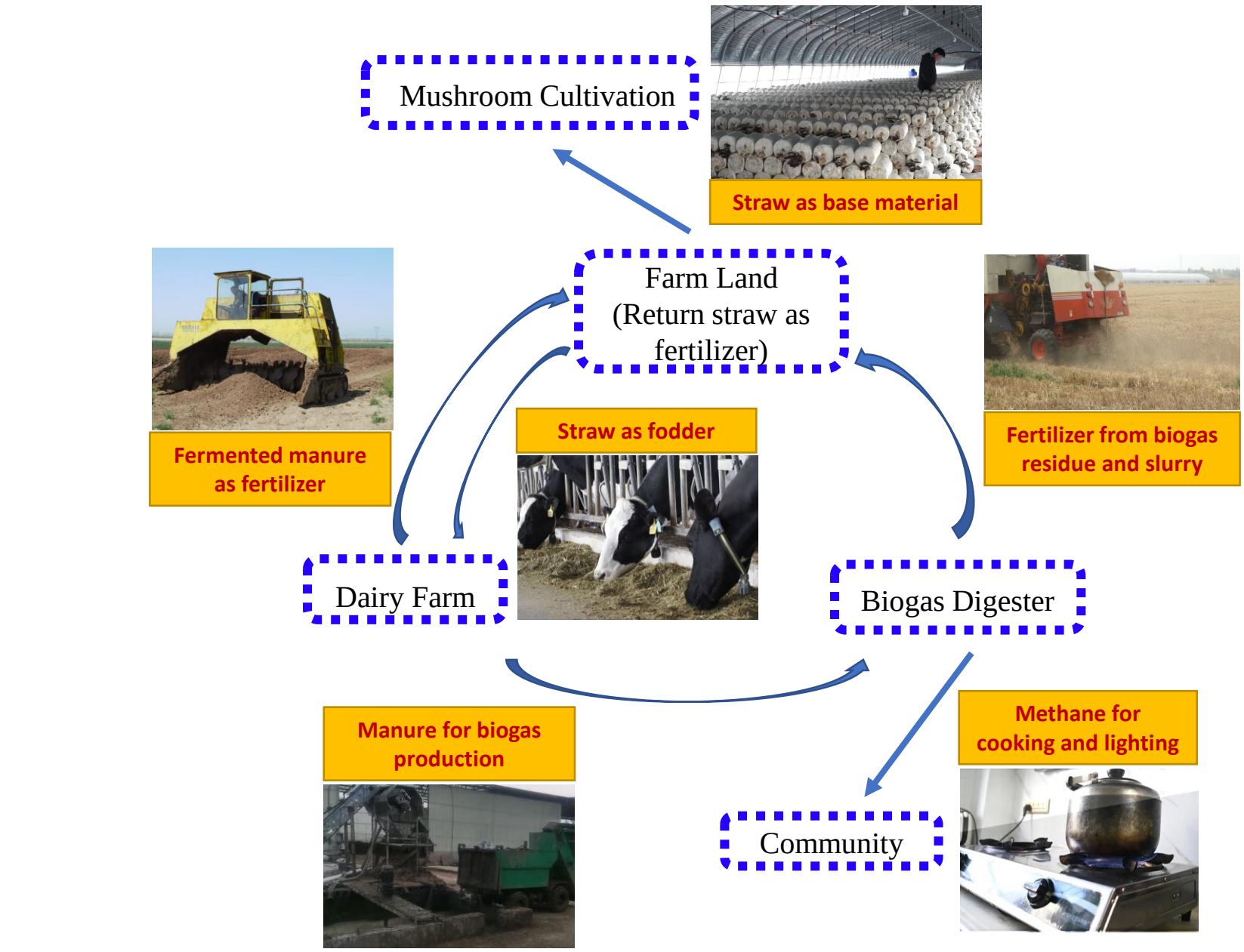
Suitable technical pattern



- Poor working performance
- Lower utilization efficiency of straw
- ….

Improve performance of integrated straw management
Optimization of technical pattern

Circular agriculture model



Demonstration sites

a) Maize b) Wheat

Demonstration site for returning straw to the field

a) Maize b) Wheat

Demonstration site for returning cow manure to the field

Data measurement and collection

Maize yield measurement

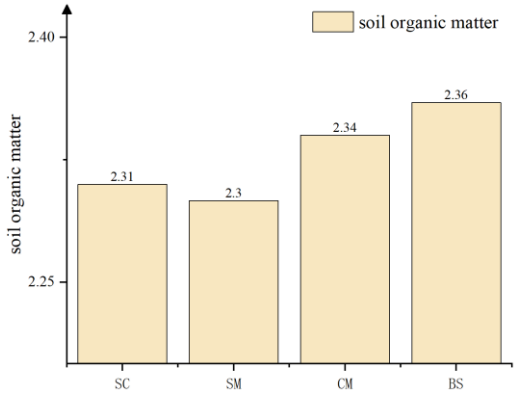
Wheat yield measurement

Soil collection and testing

Mushroom production measurement

Results and Outcomes

Ecological Indicators



Soil organic matter

345 (tons/year)

Straw burning reduction

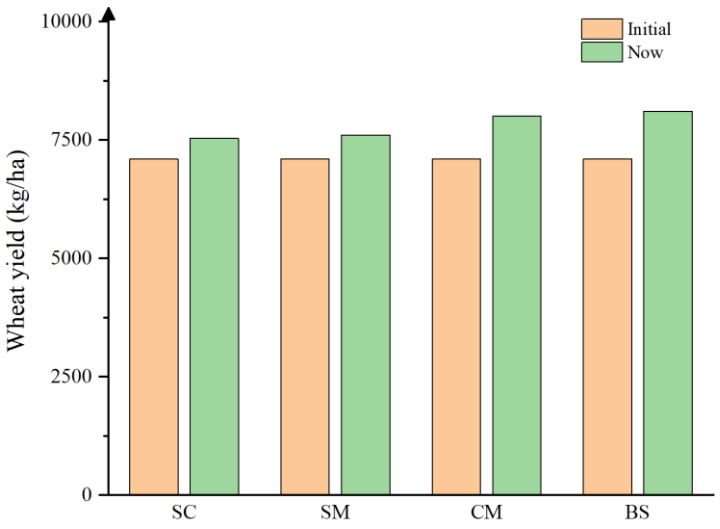
70.25 (tons/ha/year)

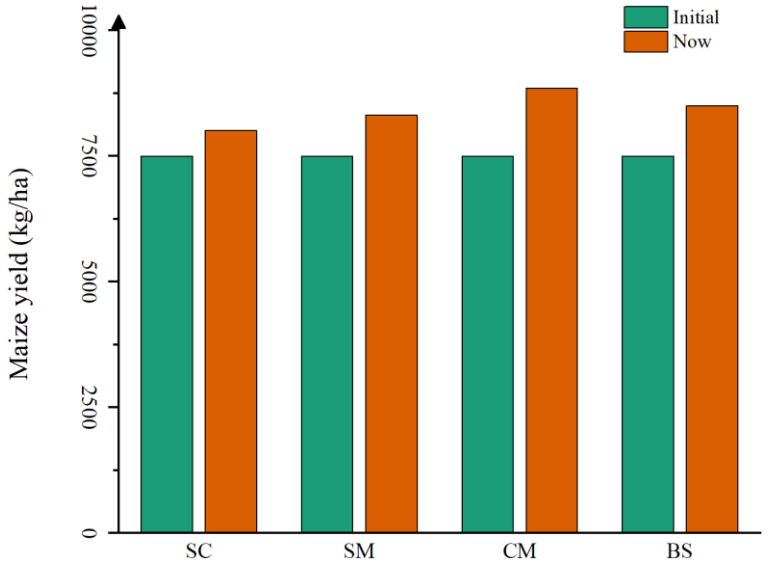
Cow manure returned to the field

The demonstration achieved improvements in ecological aspects:

1. In the field with the management of straw cover, straw mixing, cow manure returning, biogas slurry/residue returning, **soil organic matter** was increased to 2.31%, 2.3%, 2.34%, 2.36%,
2. 345 tons of **straw were utilized per year** rather than burnt;
3. 70.25 tons of **cow manure** were returned to the field as organic fertilizer per ha.

Economic Indicators





1. The maize and wheat **yields** were increased in the four treatments;
2. **Milk production** for the new fodder with catalytic enzyme was 3 ltr/day/cow (24.0 vs 21.0 ltr/day/cow) higher than the fodder in the first year;
3. 90,000m^3 of **biogas** were produced every year;
4. **Mushroom cultivation**: Each greenhouse can produce 18 tons of mushrooms every year, with a total revenue of 400 thousand yuan.

Objective 3: Technical trainings





Improve the technical level of local technicians and farmers in integrated straw utilization

Welcome to visit Laixi，Qingdao demonstration site in China!

Thanks !