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

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

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

1. Fertilizer
2. Fodder
3. New energy resources
4. Base material
Returning straw, cow manure, or biogas residue and slurry to the field.
*Fertilizer*

① Returning straw to the field _Straw cover_

- Wheat harvesting and Straw chopping
- No tillage seeding of maize
- No tillage seeding of wheat
- Maize harvesting and Straw chopping
*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

Wheat seeding  
Maize straw mixing with soils
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
Maize ensilage harvesting

Feeding cows

Cow manure collecting and separation

Returning cow manure to the field

*Fertilizer*

③ Returning cow manure to the field

Wheat seeding

Mixing cow manure with soils

Returning cow manure to the field
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

Wheat seeding → Mixing biogas slurry with soils → Returning biogas slurry to the field
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

Milk production ← Feeding cows ← Processing fodder
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**
- **Usage**
- **Biogas transportation**
- **Processing**
*Base Material*

Mushroom Cultivation

1. Base material preparation
2. Bagging
3. Sterilization
4. Harvesting
5. Mushroom cultivation
6. Mushroom inoculation
Objective 2: **Establish** demonstration site in Laixi

Suitable technical pattern

- Integrated Straw Management
  - Fertilizer
  - Fodder
  - New energy resources
  - Base material

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

Improve performance of integrated straw management
Optimization of technical pattern
Circular agriculture model

Farm Land
(Return straw as fertilizer)

Dairy Farm

Biogas Digester

Mushroom Cultivation

Fertilizer from biogas residue and slurry

Straw as base material

Methane for cooking and lighting

Manure for biogas production

Fermented manure as fertilizer

Straw as fodder

Community

Straw as fertilizer
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
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.
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. 90,000m³ 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!