

STRAW-BASED CROP-MUSHROOM SYSTEMS FOR CIRCULAR NUTRIENT USE AND SOIL RESTORATION

Summary

Millions of tonnes of crop residues are produced annually in China, yet much of this biomass remains underutilised. trans4num developed an innovative grain-mushroom rotation system that converts crop residues into valuable mushroom products while improving soil fertility, increasing crop yields, and creating new income opportunities. The system demonstrates how circular agriculture can deliver both environmental and economic benefits.

The need

Agricultural systems in the Henan region face:

- Declining soil organic matter
- Poor utilisation of crop residues
- Inefficient nutrient cycling
- Environmental impacts from residue management
- Pressure to increase productivity sustainably



The benefits

For farmers

- Additional income from mushroom production
- Higher grain yields
- Improved soil fertility
- Reduced weed pressure

For the environment

- Increased soil organic matter
- Enhanced carbon sequestration
- Improved nutrient recycling
- Reduced greenhouse gas emissions

For rural development

- New value chains and business opportunities
- Better utilisation of agricultural by-products
- Increased resource efficiency



STRAW-BASED CROP-MUSHROOM SYSTEMS FOR CIRCULAR NUTRIENT USE AND SOIL RESTORATION



trans4num solution

trans4num China developed a grain-mushroom fixed-plot rotation system where:

- Wheat and maize straw are used as mushroom substrate
- Mushrooms are cultivated as a high-value product
- Spent mushroom substrate is returned to fields
- Grain crops and mushroom production rotate across plots

The approach transforms agricultural residues into valuable biological resources while improving soil quality.

The system delivered substantial benefits:

- Wheat yield increases of approximately 23.5%
- Soil organic matter increases exceeding 60%
- Available nutrient increases greater than 40%
- Weed reductions exceeding 90%
- Improved root development and photosynthetic efficiency
- Enhanced water-use efficiency
- Increased carbon sequestration
- Economic returns reaching up to €18,000/ha

The innovation combines:

- Research institutes
- Agricultural universities
- Demonstration farms
- Technology developers
- Machinery manufacturers

Future scaling will require stronger links with farmers, cooperatives, mushroom producers, processors, and local authorities.

What were the challenges / limitations in the implementation process?



- More complex management than conventional systems
- Requires specialised knowledge
- Initial investments may be required
- Dependence on market development

What kind of resources do you need to implement the proposed solution?



- Mushroom inoculum and cultivation materials
- Technical training
- Residue handling equipment
- Market access
- Advisory and extension support

STRAW-BASED CROP-MUSHROOM SYSTEMS FOR CIRCULAR NUTRIENT USE AND SOIL RESTORATION



More information

Advisory and Policy Needs

- Farmer training on mushroom cultivation
- Advisory services on substrate management
- Development of mushroom value chains
- Support for circular agriculture initiatives
- Incentives promoting residue valorisation

Crop residues can become a valuable resource. Grain-mushroom rotations improve soil fertility, increase farm income, and demonstrate how circular agriculture can contribute to sustainable food production.

Learn more:

- trans4num Europe - <https://trans4num.eu/en/>
- trans4num China - <https://www.facisp.cn/nbs/index>

Explore more Practice Abstracts: <https://trans4num.eu/library/?type=ABS>

