# ORGANIC FERTILISER SUBSTITUTION TO IMPROVE SOIL CARBON AND NUTRIENT EFFICIENCY


## Summary

Intensive vegetable and maize production systems in China often rely heavily on synthetic fertilisers, resulting in soil degradation, nutrient losses, and declining soil carbon levels. trans4num China tested different organic nutrient management strategies that partially replace chemical fertilisers with locally available organic resources. Results show that substantial reductions in fertiliser use can be achieved while maintaining yields and improving soil health.


## The need

Farmers need sustainable nutrient management approaches that:

- Reduce dependence on mineral fertilisers
- Improve soil fertility and soil carbon stocks
- Reduce nutrient losses to the environment
- Maintain crop productivity
- Improve long-term resilience of farming systems

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## The benefits

For farmers

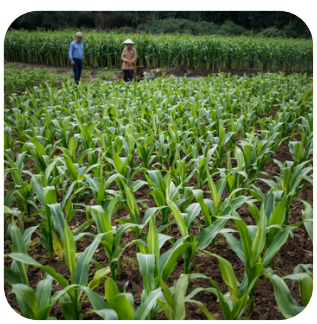
- Lower fertiliser requirements
- Improved nutrient-use efficiency
- Stable yields
- Improved soil fertility

For the environment

- Increased carbon sequestration
- Reduced nitrogen losses
- Improved soil structure
- Better nutrient cycling

For society

- Increased recycling of agricultural and food waste
- Reduced dependence on external fertiliser inputs
- Improved sustainability of food production systems



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## trans4num solution

The project tested partial substitution of chemical fertilisers in South-West China using:

- Biochar
- Chicken manure
- Food-waste-derived fertiliser
- Straw incorporation

In maize systems, organic substitution was combined with controlled-release fertilisers and improved nutrient management strategies.

**Results (Y1–Y3)**

Research showed:

- Significant improvements in soil carbon stability
- Improved soil aggregation and structure
- Maintained maize yields despite 37.5% lower nitrogen inputs
- Nitrogen surplus reductions of 75–77%
- Improved nitrogen-use efficiency
- Increased soil organic carbon under long-term straw return
- Biochar provided particularly strong improvements in carbon retention

**AKIS System**

The innovation is supported by:

- Southwest University
- Regional experimental stations
- Long-term field trials
- Research-led advisory activities

The AKIS remains largely research-driven, with opportunities to strengthen farmer participation and extension services.

**What were the challenges / limitations in the implementation process?**

- Organic materials vary in performance
- Nutrient release is slower than mineral fertilisers
- Risk of nutrient imbalances without proper management

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

- Organic amendment supply chains
- Soil testing and nutrient budgeting tools
- Technical advisory support
- Monitoring systems

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## More information

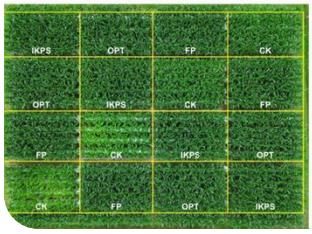
### Advisory and Policy Needs

- Nutrient management advisory services
- Farmer training on organic amendment use
- Support for circular nutrient systems
- Policies promoting recycling of organic waste streams
- Development of local supply chains for organic fertilisers

Organic fertiliser substitution can maintain yields while significantly reducing fertiliser inputs and improving soil health when supported by appropriate nutrient management.

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


| Treatment | N (kg/ha) | | | | $P_2O_5$ (kg/ha) | | | $K_2O$ (kg/ha) | Note |
|---|---|---|---|---|---|---|---|---|---|
| | UN | CRUN | ON | Total | CP | OP | Total | | |
| CK | 0 | 0 | 0 | 0 | 90 | 0 | 90 | 55 | One application as base fertilizer |
| FP | 320 | 0 | 0 | 320 | 90 | 0 | 90 | 55 | Split application of N with the ratio of Planting : Elongation : Flowering=3 : 3 : 4 |
| OPT | 100 | 100 | 0 | 200 | 90 | 0 | 90 | 55 | One application as base fertilizer; CRUN (coated with polyurethane): 90-d N release period |
| IKPS | 36 | 36 | 128 | 200 | 45 | 45 | 90 | 55 | |

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Learn more about the project at https://trans4num.eu/en/

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