

Potato Zero Tillage Under Rice Straw Cultivation

Implemented by the *Fund for the Promotion of Innovation in Agriculture (i4Ag)*
As part of the special initiative *Transformation of Agricultural and Food Systems*

The Challenge

To foster social, economic, and environmental development without overexploiting arable land and water resources

Despite their rich soil, regions with extensive agricultural production that function as “food baskets” for entire countries are often challenged by high poverty rates. The over-exploitation of natural resources (as can be seen, for example, in the form of intensive rice-wheat rotation) and the effects of advancing climate change have triggered land degradation and water scarcity. This threatens the livelihoods of smallholder farmers and their food security. Non-sustainable practices such as rice stubble-burning add to the environmental damage, as they impinge on air quality not only in rural areas, but also in urban centres (e.g., New Delhi). Resource-conserving agroecological alternatives are needed to address these growing issues. Sustainable intensification (SI) practices such as crop rotation and zero-tillage soil management practices that have proven successful elsewhere and with other crops are only marginally available to smallholder farmers in India, Bangladesh, Cambodia, and Peru.

Name of the Project	Innovative Potato Zero Tillage Under Rice Straw Cultivation for Smallholders (PZTM)
Name of the Global Fund	Fund for the Promotion of Innovation in Agriculture (i4Ag)
Commissioned by	Federal Ministry for Economic Cooperation and Development (BMZ)
Project Region	India, Bangladesh, Cambodia, Peru
Implementing Partners	International Potato Center (CIP), Wits University, Digital Green, Central Potato Research Station (ICAR-CPRS), Bangladesh Agricultural Research Institute (BARI), Prodipan, Mekong Institute (MI), Royal University of Agriculture (RUA), Asociación Pataz, Dr. Rajendra Prasad Central Agricultural University
Duration	10/2021 — 12/2024

The Innovation

Potato production through zero-tillage and rice straw or other mulch

This applied research project initially promoted an innovative approach to potato production in rice-based crop systems (“*potato production through zero-tillage and rice straw mulching (PZTM)*”) to smallholder farmers in India and Bangladesh. The technology has now been scaled in Cambodia and Peru. Unlike conventional approaches, PZTM does not require soil preparation. In the case of rice, potatoes are brought out on the unworked soil and covered with rice straw after the rice has been harvested. The potatoes then mature within the rice straw rather than in the soil; hence, at the end of the season they will then be harvested without tillage.

There are various benefits associated with this innovation. Zero-tillage results in increased soil fertility and higher carbon stocks. The soil moisture remaining after the rice harvest can be used for plant growth without the need for any downtime while waiting for ploughing; this extends the potato growing season and allows the cultivation of potato varieties that require longer times to mature. Using rice straw as mulch retains water and suppresses weeds, pests and diseases, reducing the need for harmful agrochemicals. PZTM thus increases the input-use efficiency and minimises environmental damage. In addition, PZTM allows farmers to create value for residual rice straw which would in many cases otherwise be burned — a major cause of CO₂-emissions and air pollution. Besides agronomic and climate-relevant benefits, PZTM is associated with several socio-economic benefits, including reduced costs for machinery and inputs. It also comes with tradeoffs: mulching requires labour that could be used for other household activities during fallow periods or the rice straw might be used for alternative purposes (e.g., as animal feed).



Bringing out potatoes on the unworked soil before covered by rice straw mulch, Project Region, India

The Main Objective

Innovative approaches to sustainable rice-potato farming systems are established at a smallholder level

3,000 smallholders (50% women) successfully complete trainings in PZTM

2,000 smallholders increase gross margin by 15%

50 % of soil samples indicate improved soil quality

1,000 women improve their position as agricultural producers

850 smallholders participate in trainings on practice fields

200 women self-sufficiency groups qualify as multipliers of PZTM

The project contributes to the achievement of these Sustainable Development Goals (SDGs):



Methodological Approach and Innovation Partnership

This applied research project builds on a broad partnership between CIP, MI, NGOs, and national research institutes: Digital Green, Dr. Rajendra Prasad Central Agricultural University and the Central Potato Research Station India; ProdiPan and the Bangladesh Agricultural Research Institute in Bangladesh; the University of the Witwatersrand, South Africa; the Royal University of Agriculture in Cambodia and Asociación Pataz in Peru.

Based on participatory and digital tools, this project incorporates gender-sensitive trainings to build the capacities of female and male smallholders to apply and benefit from PZTM. In India, partners work via women's self-help groups and by means of short

videos produced locally for and by farmers. In Bangladesh, trainings on PZTM will be provided through "Nutrition Scholars" — local female farmers educating their contemporaries on health and nutritional issues. In Cambodia and Peru, the tested cultivation methods are scaled into new socio-ecological contexts and with new crops for mulching.

Soil samples derived from field trials on research stations as well as on farmers' fields allow for the monitoring of soil health and soil carbon content. In addition, randomized controlled trials conducted with smallholder household representatives help disentangle the socioeconomic effects of PZTM for female and male farmers alike. The studies add to the evidence on the effectiveness of video-based advisory approaches for promoting the adoption of complex resource-conserving technologies. Based on this comprehensive data, the project will distill gender-sensitive recommendations on the promotion of PZTM as a means of sustainable intensification and agroecological transformation.

Important Activities

- Conducting gender-sensitive trainings on PZTM based on participatory and digital tools
- Conducting field trials / establishing demonstration plots (on farmers' fields)
- Qualifying women's self-help groups to act as multipliers of PZTM
- Analysis of agronomic, climate-relevant, and gender disaggregated socio-economic effects of PZTM
- Distilling gender-sensitive recommendations for the promotion of PZTM and awareness-raising through social media and events with representatives of advisory services and political institutions

Sustainability and Scaling Strategy

This project works towards perdurability and scalability through a variety of means. The establishment of demonstration plots in combination with a training-of-trainers approach, allows for the local building of capacity and knowledge. In addition, women self-help groups are qualified to act as PZTM multipliers, ensuring the continuation of knowledge-sharing beyond the project. Existing training materials and digital tools will be updated to include PZTM. Gender-sensitive recommendations for the promotion of PZTM will be made available to relevant national and regional stakeholders in policy, research, and advisory to lay the groundwork for national and international up-scaling.

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