

# Info Note

## Conservation agriculture for a climate-resilient and sustainable upland agriculture

*A success story from a seventeen-year local program in northern Vietnam*

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### Key messages

- **Economic benefits:** Conservation measures on hillslopes increase cassava yield and productivity, reduce investment, and improve household incomes from added components.
- **Environmental benefits:** Conservation measures on hillslopes contribute to climate adaption in terms of improved soil physical properties and reduced erosion and climate mitigation, including better soil fertility (carbon sequestration) and reduced impacts of herbivorous spider mites.
- **Social benefits:** Conservation measures on hillslopes can be accepted by farmers given their economic and environmental impacts and their suitability and applicability in mountainous regions.
- At the institutional level, this success story can be replicated in areas with similar biophysical and socio-economic conditions given strong determination and commitment like those of the government of Van Yen in the last two decades.

Vietnam's great performance in agriculture in recent decades has been very impressive, i.e. the country achieved its food security goal and became the second top rice exporter and the top coffee producer. However, these goals were achieved at the expense of efficiency, farmer welfare, and product quality, eventually leading to environmental costs (World Bank, 2016). For example, input- and resources-based strategies to keep up with maximum yields were prioritized over conservation and sustainability measures. These strategies depleted the soils with necessary nutrients and led to more intense soil erosion (Tuan, 2015), land degradation, uncontrolled

forest invasion for agriculture, and increased incidence of infectious diseases among plants and crops (Wyckhuys et al., 2017). Climate anomalies worsen these problems, which are evident in the northern mountainous region (NMR), the country's poorest region.

Over the past decades, intensive farming without protection measures on hillslopes to meet the demands of a growing population and markets in the NMR of Vietnam has led to unsustainable upland agriculture and local livelihoods. A specific impact that emerged was soil degradation due to severe erosion and nutrient depletion, affecting crop productivity and in turn reducing household incomes. Climatic factors such as more intense rainfall and more frequent droughts and cold spells have worsened the farmers' situation. The government of Vietnam, through the provincial and local departments on agriculture and rural development, has launched many sustainable development programs to restore the sustainability of agriculture in the NMR. One of these programs, a seventeen-year cassava-based conservation agriculture initiative in Van Yen District in the NMR, was the focus of the C-2019-148 research project. The project implemented an impact assessment for six conservation measures (Figure 1), comparing them with the traditional cassava monocropping system using the economic, environmental, and social lenses.

### Key lessons learned

The study showed that tapping into the local knowledge, fully evaluating the needs and capacities of communities, and fostering a more serious commitment from the local governments can make a development program successful.

**Farmer meetings and focus group discussions can help correctly identify and assess problems and needs for sustainability improvement and obtain farmers' commitment to change.** Participatory discussions with farmers can help best analyze the situation (e.g., biophysical and socio-economic conditions) of an area and thoroughly assess its needs (e.g., activities to improve adaptation and resilience capacities) for change. This exercise also helps evaluate the available capacities, willingness, and commitment of local people, and the extra investment needed to implement a new program.

**Institutional determination, participatory planning, and routine practices can help initiate a successful local development program.** To sustain the work in the long run, the government of Van Yen allocated a large amount of annual investment and provided farmers with technical training, materials (seeds, varieties, inputs, etc.) and subsidies for their harvests. By setting out specific annual targets with detailed investments and implementation plans, reaching as many farmers as they could, Van Yen turned almost 8,000 hectares of unprotected sloping arable land into conservation agriculture areas seventeen years into the project's implementation.

## Key lessons from implementation

Over the seventeen years of implementing the local program, the introduced conservation measures have increased cassava yield and household income (economic), restored soil quality (environmental) and

been well accepted and practiced by Van Yen farmers (social). These key impacts are detailed as follows.

### Conservation measures helped improve economic impacts

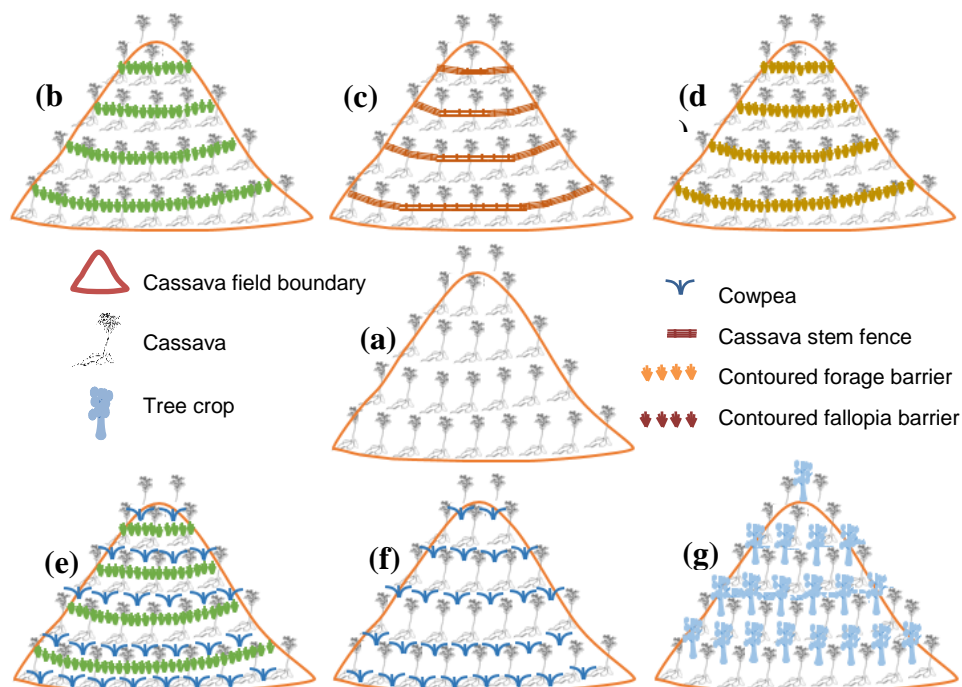
*Improved cassava productivity:* All six measures have registered higher cassava production than the monocropping system. Specifically, cassava-contoured forage barriers and cowpea and cassava-intercropped cowpea have the highest production volumes.

*Reduced investment in the long run:* Farmers applied more inputs in the first few years of adoption but lessened their application from Year 3 to Year 5. This is because the extra investment was needed for additional components in cassava fields. After three to five years, these components improved soil conditions; investments were not that needed anymore. The cassava-contoured forage barriers and cowpea and cassava-intercropped cowpea demonstrated the lowest levels of investment.

*Reduced yield instability:* Due to the restored soil fertility and improved soil physical properties from the adoption of conservation measures, cassava growth and yield slowly improved and became more stable. Cassava-contoured forage barriers generated the highest yield stability among the introduced measures.

### Conservation measures helped improve environmental impacts

*Improved soil quality:* Overall, soil conservation measures have improved soil quality over the years of implementation. Soil fertility parameters (organic carbon –



**Figure 1.** Illustration of cassava-related management practices identified in the study (Bui et al., 2020a)

(a) Cassava monocropping; (b) Cassava – contoured forage barrier; (c) Cassava – contoured cassava stem fence; (d) Cassava- contoured fallopia barrier; (e) Cassava – contoured forage barrier – cowpea;

$C_{org}$  and total nitrogen – N<sub>t</sub>) have significantly increased, applying the cassava-forage barriers measure over different periods compared to cassava monocropping (Figure 1). Other soil physical properties such as infiltration rate (Bui et al., 2020b), topsoil aeration, thickness of plow layer, and dark topsoil color (Bui et al., 2020a) also received higher scores in conservation measures.

*Reduced impact of cassava spider mites:* The farmers' observations revealed that the impact of red spider mites on cassava is much less in conservation measures compared to the traditional monocropping system. The lowest levels of impact were recorded from cassava-contoured forage barriers and cowpea and cassava-intercropped cowpea measures. The latter is also quantitatively proven in the study of Nguyen et al. (2020) conducted in Mau Dong Commune from 2018-2019.

### Conservation measures helped improve social impacts

*Social acceptance of introduced measures:* Farmers highly appreciated the suitability and feasibility of these practical measures in their existing farming systems, experience, and available production materials (Bui et al., 2020). This shows the success of the program within the cassava communities of Van Yen District.

*Gender equity in making decisions of management practices:* The study shows that men are the top decision-makers in households (42%). Still, the study also shows a high percentage of husbands and wives making decisions together (36%). Wives as the top decision-makers only account for 20% of the surveyed households (Bui et al, 2020).

*Social inclusion and participation in adoption of measures:* The Van Yen program has reached most of the cassava villages and organized trainings inclusively for as many farmers as it could. The study reveals that farmers were more interested in attending technical trainings on conservation measures than those discussing the traditional cassava monocropping system.

## Recommendations

Upland conservation agriculture has been prioritized for the mountainous regions of Vietnam. However, conservation measures with evidence on climate mitigation and adaptation are essential for the National Target Program-New Rural Development (NTP-NRD) 2021-2025 Strategy. Therefore, the following actions are recommended:

1. Aggregate all scientific studies related to the Van Yen success story such as Bui et al. (2020a), Bui et al. (2020b), Nguyen et al. (2020), and Vu et al. (2020) as evidence for scaling. These studies provide concrete

science-based evidence of the impacts that upland dwellers must anticipate and address in the absence of conservation measures: degraded land, reduced production, and affected local livelihoods. This is to help local governments redesign their priorities for development and trigger an investment mechanism for climate adaptation and resilience in driving upland agriculture back to sustainability.

2. Utilize this evidence to align the outcomes of the CGIAR Research Program in Climate Change, Agriculture and Food Security (CCAFS) with those of the NTP-NRD for the period, 2021-2025, especially climate resilience and adaptation. A task force under the project CCAFS P1596, in collaboration with the Ministry of Agriculture and Rural Development and other knowledge partners, works to mainstream CCAFS outcomes into the development of measurable indicators of climate resilience in the NTP-NRD 2021-2025 Strategy. This set of evidence can help in: determining the needs to adopt adaptation and mitigation measures, as well as the available local resources and capacities for efficient investment and implementation across ecological regions; setting national indicator matrices to measure the correct implementation of climate-smart conservation measures in climate-vulnerable mountainous regions; providing clues to make the most efficient national investment plans to implement climate-resilient agriculture in vulnerable regions; and considering the integration of CCAFS outcomes about climate-resilient agriculture into the implementation of NTP-NRD 2021-2025 nationwide.

## Further reading

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*This brief summarizes the results of an impact assessment of a local seventeen-year initiative on cassava-based soil conservation measure on sloping land as a climate-smart agriculture practice in Van Yen District, Yen Bai Province, Vietnam. The research is carried out by Vietnam National University of Agriculture (VNUA), research consultant at the International Center for Tropical Agriculture (CIAT), and CCAFS.*

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