



Australian Government

Australian Centre for
International Agricultural Research

Soil and land management

Crop health and nutrient management of shallot-chilli-rice cropping systems in coastal Indonesia



Overview

Indonesia's coastal and upland agricultural systems vary in intensity from predominantly low-input rice production to highly intensive mixed rotations including high value vegetables. Indonesia's most significant vegetable commodities are shallot and chilli, which are integral ingredients for its unique cuisine.

The profitability of traditional rice-only cropping systems has dropped substantially over the last 30 years, despite yield improvements. The heavy reliance on lower-value cropping limits opportunities to reduce rural poverty, so diversification in rice-based farming systems is important.

Vegetable cropping offers the best chance to reduce rural poverty, but vegetable-based production systems have a large range of constraints that have negative economic, social and environmental impacts. Productivity losses are caused by a range of factors including degraded soil properties, climatic impacts, poor agronomic management, biotic stresses and excessive use of pesticides and fertilisers.

In many Indonesian rice-chilli-shallot farming systems the rates of nitrogen application are up to 300kg per hectare, while crop uptake is only approximately 80kg per hectare. Another serious concern is the use of multiple pesticide products with up to 28 spray applications over a 55-day cropping cycle. The intensive use of pesticides and excessive use of fertilisers present significant health risks for poor rural workers and risks of environmental contamination.

KEY FACTS

ACIAR Project No. SLAM/2018/145

Duration: March 2020 to December 2023 (4 years)

Target areas: Indonesia

Budget: A\$2,000,001

Project Leader

Dr Stephen Harper, University of Queensland

Key partners

- Department of Agriculture and Fisheries
- Indonesian Centre for Agricultural Land Resources Research and Development
- Gadjah Mada University
- Indonesian Vegetable Research Institute
- Bogor Agricultural University
- Balai Pengkajian Teknologi Pertanian Yogyakarta

ACIAR Research Program Manager

Dr James Quilty

Objective

This project will address the key issues and challenges associated with the safe, sustainable production and intensification of high-value vegetable cropping options, particularly shallot and chilli, in Indonesia's sensitive coastal agro-ecosystems.

The objectives are to:

- Identify nutrient loss pathways and develop strategies to reduce excessive fertiliser inputs in the coastal agro-ecosystems.
- Mitigate the impact of soil pathogens and improve soil biology in coastal vegetable production.
- Evaluate the potential impact of undiagnosed soil and nutrient constraints to vegetable production.
- Develop multi-faceted strategies for the management of pepper yellow leaf curl virus.
- Optimise and extend strategies to reduce excessive pesticide use and improve efficacy in vegetable systems.
- Evaluate the impact of improved agronomic practices for productivity and seed production in the priority allium crops.

Expected scientific results

- Identify single gene resistance for pepper yellow leaf curl virus, and identification of resistance to fusarium in shallot germplasm.
- Understand nitrogen dynamics in coastal production systems, and particularly of nitrogen loss pathways, including leaching and volatile losses.
- Identify vegetable germplasm that has improved fertiliser use efficiency through improved nitrate uptake and root system improvement.
- Develop information on sustainable soil management and long-term changes in soil fertility.
- Develop knowledge and methodologies to evaluate interactions between soil pathogens and soil chemical factors.
- Understand perceptions and exposure risks within shallot-chilli-rice farming systems and associated communities in Indonesia, which will support efforts to improve the health and wellbeing of agricultural communities in Indonesia.
- Develop real time polymerase chain reaction to quantify virus titre in garlic and shallot seed.

Expected impact/outcomes

- Improve nitrogen use efficiency will increase the profitability of shallot and chilli production and reduce environmental impacts.
- Understanding of nitrogen loss pathways will identify potential impacts on greenhouse gas mitigation or losses to marine habitats with the aim of influencing relevant government policies.
- Increase profitability of shallot-chilli production, as a result of reduced fertiliser and pesticide use.
- Improve health of poor rural workers due to reduced pesticide exposure.
- Develop and implement a 'Best Bulbs' training package for shallot and garlic production, including reselection and correct storage of bulb seed, and crop nutrient management, leading to improved household incomes for growers through increased yield, quality and price.
- Develop fundamental knowledge among soil scientists and agronomists to underpin future research opportunities.
- Develop a template for advancing opportunities for diversification with high-value cropping.

