



Identifying Eastern Gangetic Plains soil constraints

Overview

The External Supplemental Review of the Sustainable and Resilient Farming Systems Intensification project (CSE/2011/077) identified soil health as an area of concern, with soil pH and associated toxicities, trace element deficiencies (Zn, Cu, B), low organic carbon levels, and soil structural problems identified as key issues. The review identified the following opportunities and needs for further soil health research:

- » Investigate use of lime and/or trace elements to address soil pH barriers to economically viable crop and forage production
- » Investigate opportunities to enhance soil organic carbon levels through better management of soil mulching
- » Give greater emphasis to the development of site specific soil nutrient management particularly for rabi crops
- » Investigate the opportunities for an increased emphasis on the production of biologically fixed N through the greater use of legumes and pulses.

This Small Research Activity (SRA) will provide additional information to allow the validity of future research needs to be determined. The SRA will focus on the following questions:

1. In areas where N fertiliser use has increased, are soils acidifying, and how rapidly is this acidification process likely to proceed?
2. Is Zn (B) deficiency widespread, and will application of Zn fertiliser increase rice yields?
3. Is the organic matter increase observed under conservation tillage practice resulting in an improvement in soil structure?
4. What insights into system sustainability can be gained from simple partial nutrient budgets?

ACIAR project number	CROP/2018/210
Start date and duration (years)	December 2018 - June 2020 (19 months)
Location	India, Bangladesh, Nepal
Budget	AU\$250,000

Project leader(s) and Commissioned Organisation

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Research

Evaluation of the extent of soil acidification, and risk/rate of acidification.

Soil pH is not commonly measured on Eastern Gangetic Plains soils, hence there is little information available on the current pH of the soils, or their pH trend. On the basis of high rates of use of ammonium fertiliser, and the relatively coarse texture of the soils, there is a risk that the soils are acidifying. Thus there is a need to measure soil pH to determine the extent to which this potential problem is an actual problem.

The activity associated with this objective will provide data on which an assessment of the impact of soil acidification can be made.

Evaluation of the zinc status of rice crops, and the potential for a yield response to zinc fertiliser application.

Gangetic plains soils are frequently reported to be of low zinc status, and foliar symptoms consistent with zinc deficiency are widely observed in rice crops. However, zinc fertiliser is not used routinely, and many agricultural advisors do not consider that rice crops will respond to zinc. An objective of this SRA is to determine if rice crops respond to zinc fertilization, and if improved growth results in increased grain yield.

Evaluating the soil structural benefits of conservation agriculture.

Conservation agriculture practices such as zero tillage are generally reported to increase soil organic matter contents, especially in surface soil layers. As implemented in the Eastern Gangetic Plains, the effect of retaining stubble and reducing tillage in the rabi season (e.g. wheat) crop, are dissipated to some extent in the kharif season (rice) crop. Nevertheless, increased soil organic carbon is an anticipated benefit of the adoption of conservation agriculture. While there are multiple reasons why increasing soil organic matter may be considered beneficial, the effects of organic matter which most directly impact on crop production are its effects on soil structure. This objective is to determine if adoption of conservation agriculture (as practiced in the Eastern Gangetic Plains) has resulted in improved soil structure.

Calculation of preliminary partial nutrient budgets.

Simple nutrient budgets can be calculated on the basis of fertiliser inputs and crop removal. Such crude budgeting differs in its accuracy between nutrients, with budgets for mobile and readily dissipated nutrients like N poor, but for less mobile nutrients like P, more robust. Even this simple approach can identify where substantial imbalances (deficit / excess) occur, and where the major flows of nutrients are occurring. Where suitable data is available for cropping systems, preliminary budgets will be calculated. While we recognise the potential errors in this approach to budgeting for nitrogen, we will nevertheless calculate nitrogen budgets to contribute to the understanding of acidity input of Objective 1.

Note that in each aspect, the objectives are limited to determining if there is a problem / response etc. Within the SRA, we will not attempt to determine how the issues identified can best be addressed.

Anticipated outcomes/ Achievements

This SRA aims to provide information to determine whether there is a problem/response associated with each constraint, to inform future research work.

