

3.3 Field-scale interventions to improve soil physical properties and fertility

Background

Soil is the foundation of agriculture. The productivity of agricultural systems is often limited by physical (e.g. shallow depth, poor structure, high mechanical impedance), chemical (low available nutrient content, high or low pH), or biological (high soil pathogen load) soil constraints. These are often associated with low levels of soil organic matter. Some constraints occur naturally while some are a result of agricultural activities (i.e. soil degradation). Some are very expensive or impossible to rectify (irreversibly poor or degraded soils), but many can be overcome, or prevented from developing, by farmers using appropriate soil-management techniques.

Soil conditions that are suboptimal for the crop and climate prevailing are probably the biggest reason for the gap that remains between actual and potential farm yields in developing countries. This gap is probably of the order of 40% of attainable yield, and at least half of the shortfall can be attributed to poor soil management.

Key strategies

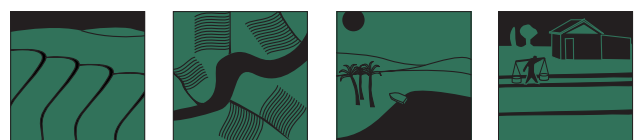
Research to develop appropriate soil management techniques for developing countries must consider several widespread trends:

- There is an increasing intensity of cropping (number of crops per year) as rest, fallow or ley periods are reduced, and a move towards continuous crop monoculture or, at best, simple binary rotations.

- Mechanisation is increasing, reflected in growing numbers and sizes of tractors and seeding and tilling implements (e.g. in Bangladesh).
- There is less manure from draught animals, but more manure from a growing livestock sector dedicated to meat, milk and egg production, which is often more localised and further from croplands.
- Awareness is increasing of small-scale variation arising from soil type and field history, the latter being especially important where field size is small.
- There is a growing use of inputs in many developing countries, especially fertiliser use, as infrastructure and institutional constraints are gradually removed.
- Input and output prices are approaching import parity levels, as World Trade Organisation membership spreads.
- There has been a significant increase in interest in organic agriculture. There is a tendency to promote organic agriculture as the best solution for sustainable soil management in the developing world. However, it is unrealistic to urge strict organic regimes, if only because the need for nutrients to replace those that have been or are being removed by cropping far exceeds the available supply of organic nutrients.

Implementing the strategies

ACIAR will support projects dealing with techniques for improved soil management where they align with the realities of modern agriculture described above and with the





3.3 Field-scale interventions to improve soil physical properties and fertility

Better Environments from Better Agriculture



agreed priorities of individual countries. The following specific areas will be considered:

- crop rotations that add useful diversity to the system, especially including nitrogen-fixing legumes, and disease- and pest-eradicating or catch crops, or biofumigant crops;
- tillage systems for draught animals and small-scale tractors, especially systems leading to reduced or zero tillage, and to the retention of crop residues as a protective cover on the soil surface (conservation tillage), together with tillage and soil-shaping research relating to better management of irrigation water;



- use of fertilisers to ameliorate soil conditions such as acidity, and to increase soil fertility, including techniques to aid the diagnosis of deficiencies, to better quantify correct doses, and increase nutrient uptake efficiency, and improved systems to deliver the most appropriate product to farmers;
- biofertilisers, alone or in combination with synthetic fertilisers, where there is sound evidence of likely success; and
- systems to make best use of animal manures and other organic sources of nutrients and soil cover.



Post: GPO Box 1571
Canberra ACT 2601
Australia

Phone: +61 2 6217 0500
Fax: +61 2 6217 0501

Email: aciar@aciar.gov.au
Web: www.aciar.gov.au