NSW GOVERNMENT Industry & Investment

Research for Action
soils & organics




I&I NSW – PROFITABLE, ADAPTIVE AND SUSTAINABLE PRIMARY INDUSTRIES IN NSW

Research for Action 2009-2013

Soil research

Soil research priorities are driven by the need to increase food security, agricultural and forest productivity, adapt to climate change and improve environmental management. Global demand for food is anticipated to double by 2050, placing high demands on soil resources used in agricultural production systems. The need for sustainable timber supplies will also place additional pressure on soil resources. There is increased competition for land and soil resources to meet food, timber, fibre and energy needs and to house rapidly expanding urban populations. To meet these challenges, the soil resource base must be managed to prevent further loss of productive capacity and to increase agricultural and forest productivity. Sound soils research will underpin land use policies to balance these competing demands. Research into soil ecological processes will establish sustainable soil management practices to restore soil fertility and prevent land degradation.

NSW has a diverse range of soils and landscapes that support agriculture, horticulture and forestry. Many soils are highly weathered, with low natural fertility, or have been degraded after inappropriate management. Degrading processes include erosion, acidification, nutrient depletion, contamination, loss of soil carbon and soil structure, and mobilisation of salts. These processes reduce the productive capacity of soils and are slow and costly to remediate.

Introduction of sound agricultural and forestry management practices has increased the productivity of some soil landscapes by increasing the availability of soil nutrients, particularly nitrogen and phosphorus, and improving soil structure and water holding capacity. Sound soil management has also increased soil carbon in these landscapes. Soil protection measures, soil amendments, fertilisers, specialised tillage practices, forest establishment techniques and pasture-crop rotations have all helped manage or reverse soil degradation.

Sound soil management can also mitigate environmental problems such as greenhouse gas emissions, poor water quality, water scarcity and stream sedimentation. Soils can be both a source or sink for carbon dioxide and methane. There is significant potential to increase soil carbon storage and reduce green house gas emissions such as nitrous oxides and methane, through use of good soil management and applications of amendments such as biochar and recycled organic materials. The health of waterways relies on managing soil erosion, soil water and groundwater flows in catchments. Acid sulphate soils require specialised hydrologic management to prevent and reduce acidification of waterways.

Organic agriculture

Organic farming systems rely on ecological processes rather than external industrial inputs to produce food and fibre. They take advantage of naturally adapted genotypes and mixed production systems that enable production without the need for manufactured pesticides and fertilisers. Further scientific studies are needed to ensure these systems are sustainable and use effective practices and technologies.

There are strong synergies between research into organic systems and soils. There is an opportunity to increase understanding of the mechanisms by which organic amendments and management techniques affect soil biological processes, plant nutrition and health. These mechanisms include the effects of

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organic management on soil borne pathogens, phosphorous and nitrogen nutrition, and root function. It is hypothesised that specific amendments and rotations can manage the interactions between soil physical and chemical properties, microorganisms and plant roots to provide adequate plant nutrition and improved plant health. Novel soil indicators of desirable biological and physio-chemical functional condition need to be identified. Management practices that better match nutrient release from soil sources with plant uptake requirements need to be investigated. There is potential for nutrient supply-demand imbalances to be influenced by managing soil physical and chemical properties with organic amendments, by selecting for better rooting characteristics and developing microbial inoculants which enhance nutrient uptake.

The role of the Science and Innovation Division of Industry & Investment NSW

The key questions that research needs to answer are:

- Which soil management technologies most effectively protect and enhance the productive capacity of soils for primary industries?
- Which soil management practices reduce adverse effects on water quality?
- How can degraded soils be remediated?
- How can the performance of organic production systems be improved?

There are also clear links between soil and organics research and other priority research themes for Science & Innovation, particularly, Climate; Water Management; and Productivity & Food Security.

OUTCOME	
Productive and resilient soils for primary industries with improved environmental conditions	
Objectives	**Strategies**
To develop technologies and management systems that reduce soil physical, chemical and biological constraints to productivity, build resilience and reduce adverse environmental impacts	1. Develop technologies and management systems that minimise soil degradation and enhance soil, chemical, physical and biological capacity. 2. Develop technologies and management systems that enhance soil resilience to climate change, enhance soil carbon sequestration and reduce green house gas emissions 3. Develop technologies and management systems that protect the natural environment including water quality and natural ecosystems 4. Communicate science findings to government, industry and community




OUTCOME

Primary producers have access to high quality microbial inoculants to improve soil fertility

Objectives	Strategies
To improve and maintain the quality and effectiveness of microbial inoculants for primary industries	5. Increase the effectiveness of new and existing inoculant technologies to improve yields through biological processes in soils 6. Investigate the suitability of alternate formulations to provide increased survivability of beneficial microbes applied to seed or soil 7. Determine the stability of new, selected microbial strains in different carriers during manufacture. 8. Screen, maintain and supply high quality authenticated rhizobial and non-rhizobial cultures for inoculant manufacture 9. Establish a Code of Practice for microbial inoculant products linked to a registered trade mark for quality 10. Assess and report the quality of microbial inoculants at point of manufacture and sale 11. Communicate science findings to government, industry and community

OUTCOME

Recycled organic and inorganic resources are sustainably reused in agriculture and forestry

Objectives	Strategies
To evaluate the role of recycled organic and inorganic resources in primary production	12. Investigate the properties, benefits and risks of organic and inorganic waste resources used as soil amendments and sources of nutrients 13. Investigate the role of soil properties, climate and management systems on efficacy of recycled materials applied as soil amendments 14. Develop guidelines for use of organic and inorganic recycled materials 15. Communicate science findings to government, industry and community

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OUTCOME

Productive and sustainable organic production systems which meet the needs of primary producers and consumers

Objectives	Strategies
To develop locally adapted and productive organic farming systems which use management strategies based on agro-ecological and biological processes	16. Assess the constraints and opportunities for expanding organic production systems and integrating organic methods into conventional production systems 17. Identify the association between the role of soil micro-organisms, soil physical and chemical properties, plant roots and management practices which enhance plant nutrition and improve plant health 18. Develop effective technologies and management systems which enhance the ecological cycling of nutrients and prevent soil degradation through nutrient depletion or structural decline 19. Develop effective technologies and management systems which safely control pests, diseases and weeds using ecological processes 20. Communicate science findings to government, industry and community