

MANAGING SUBSOIL ACIDITY (GRDC DAN00206)

The opportunity cost of soil acidity

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<http://www.dpi.nsw.gov.au/agriculture/soils/acidity>

This issue provides an agro-economic framework for assessing the opportunity cost of soil acidity that investigates investment potential of a range of innovative soil amendments and technologies to prevent and ameliorate subsoil acidity in the southern grain region.

Introduction

An economic analysis is a process of evaluating the costs and benefits of investment to help managers make a better decision in allocating resources such as land, labour and capital.

More than half of agricultural land in NSW is acidic, and the gross value of agricultural production lost due to soil acidity is estimated at \$378 million per year in NSW only. Rate of soil acidification increases as production increases due to increased product removal, therefore it is necessary to consider the financial consequences and strategies to manage soil acidity in production systems.

The objectives of this analysis are to explore the relationships between agricultural productivity, profitability and soil acidity, and evaluate the costs and benefits of alternative soil management options.

Rationale

Efforts to ameliorate soil acidity and mitigate soil degradation today would be an investment in the future. The benefit-cost analysis allows estimation of the rate of return on investment that the individual is willing to receive today to achieve sustainable production into the future.

In the absence of soil amelioration effort, land productivity and profitability would decline. In the face of increasing soil acidification, the current land use may continue as long as an equal return on fixed capital could be obtained. If the land resource is degraded the potential profits would also be reduced.

Agro-economic framework

If the soil is acidic, its negative economic impact could be managed by growing acid tolerant crops and pastures and the rate of acidification can be reduced in various ways. These include protecting soils from becoming more acidic by applying ameliorants; using less acidifying fertilisers; minimising nitrate leaching by growing perennial plants; and retiring the land from agriculture.

Figure 1 provides an agro-economic framework to evaluate the economic impact of various soil acidity management options. The framework captures impacts of variations in seasonal, site, soil acidity and management decisions on crop productivity (green boxes), and impacts of changes in the costs and price alternative management strategies on profitability (blue boxes).

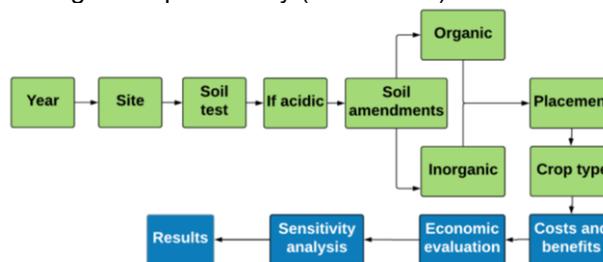


Figure 1. Agro-economic framework

Costs and benefits

The costs of ameliorating soil acidity include the cost incurred for purchasing soil ameliorants, production and productivity losses, machinery and application costs.

The benefits of ameliorating soil acidity are the increase in crop yield and saving from a reduction in the variable costs resulting from the proposed technical and management changes.

Data on any capital expenditures will be included where appropriate. For example, investment in liming and deep ripping may have benefits that last for more than ten years. On-farm long-term

average input and commodity prices will be used for estimation.

Figure 2 shows the three possible scenarios of costs and benefits in relation to increasing levels of soil acidity: the safe, the critical and the penalty zones. Net benefit increases with increasing levels of acidity but at a decreasing rate and eventually declines. In the safe zone, investment in ameliorating soil acidity is profitable. Investment in the critical zone is justifiable if net benefits are positive. If pH is lower than the upper limit of critical zone (e.g. 4.8 in CaCl₂, to be confirmed by field experiment), various forms of penalties are incurred, including production loss, limiting crop choice to acid-tolerant species or varieties.

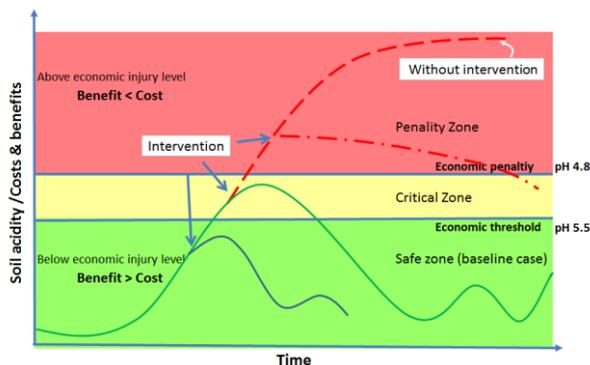


Figure 2. The possible movement of costs and benefits in relation to increasing levels of soil acidity.

Economic analysis

The assessment of soil acidity considers farm productivity, production and income with prevailing levels of soil acidity and the likely prospects of alternative farming activities given expected prices and technological developments. The net present values, benefit cost ratios and pay-back periods will be estimated for each management option compared with the baseline cropping system(s).

The positive returns on investment can be obtained by slowing the acidification rate over time rather than halting or reversing soil acidity. The costs of soil acidity can be reduced by moving in favour of farming activities that minimises the adverse effects on farm profitability.

It is expected that there will be both productivity and profitability benefits resulting from investment in ameliorating soil acidity if investment decisions are made before the soil acidity falls below the economic threshold level.

The marginal benefit from managing soil acidity with and without soil ameliorants is estimated as

shown in Figure 3. If soil is restored before the soil becomes too acidic, agricultural production may be sustainable (green line). However, if soil amendments are not added, the productivity declines with increasing levels of acidification (blue line) and eventually declines rapidly. The opportunity cost of managing soil acidity is the difference between the marginal benefits with and without soil ameliorants (red line).

Hence, at the individual farm level, action to prevent or ameliorate degradation is likely to occur if the conservation effort and expense yield a positive stream of farm income benefits. This would generally occur if the net present value of investment in ameliorating soil acidity justifies the costs at given commercially applicable discount rates, input and commodity prices. If such returns are not available, there will be an opportunity cost of ameliorating soil acidity and thus farm investment in soil acidity would not be justified.

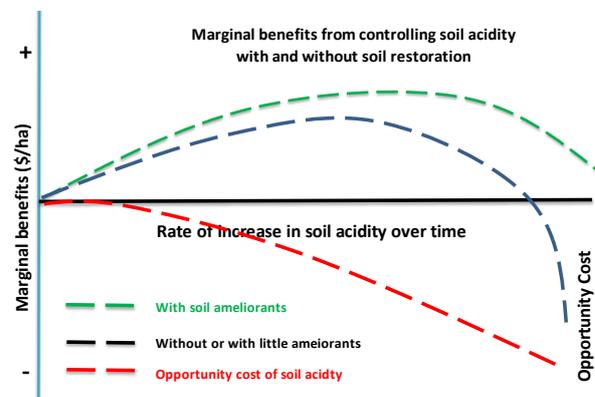


Figure 3. The marginal benefit from managing soil acidity with and without soil ameliorants.

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