Two levels of information are required to assist extension of liming in Western Australia

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Abstract

Recent soil surveys have shown that soil pH in the central agricultural area of Western Australia is lower than was suggested by previous estimates. This situation adds weight to data from lime sales suggesting that while lime use has increased from a drop in the early 2000s, it is still below the amount required to adequately treat existing and on-going acidification. Focus group workshops were conducted at three locations in the central and eastern wheatbelt of Western Australia to identify whether there are common barriers to the use of lime amongst farmers in this region.

The responses and comments of the participants at the workshops highlighted the chief importance of economic factors (costs, returns and cash-flow) on the ability to carry out liming. Two groups of farmers were identified with differing, though related information needs. The first group is largely convinced of the value of liming. Their main information needs are for more detail in terms of lime requirements, responses to liming and efficiency of liming to make the dollars spent on liming as effective as possible. The second group did not appear to be entirely convinced of the value of liming. The main information needs identified by this group fell into two broad categories of fundamental information about lime, pH changes and rates as well as further information about responses to liming, the rates required to achieve pH targets and the economics of liming. The results of this study will help to direct extension of soil acidity and liming information for farmers in the Western Australian wheatbelt.

Key Words

soil acidity, lime use, information needs, Western Australian wheatbelt

Introduction

Soil acidity is a major constraint to agricultural productivity and sustainability in Australia. It has been estimated that half of the agricultural land in Australia is acidic (pH_{CaCl2}) ≤ 5.5) and up to half of that area requires immediate remedial action (pH_{CaCl2}) ≤ 4.8) (NWLRA 2001). Previous estimates suggested that two-thirds of the soils in the wheatbelt of Western Australia (WA) were acidic or at risk from soil acidification (Porter *et al*. 1995). A recent spatial analysis of pH data from samples of soil collected from farmers' paddocks has provided a more detailed estimate of the extent of the problem (Andrew and Gazey 2010). The analysis, which was based on data from 39 480 geo-referenced locations from paddocks across the central agricultural area of WA, estimated that 6.5 million hectares, or 78% of top soil (0–10 cm) was extremely to moderately acidic (pHCaCl2 4.3–5.5), while 3.5 million hectares of subsurface soil (10–30 cm) was extremely to highly acidic (pHCa Cl2<4.8). This analysis is supported by a recent national assessment, based on an analysis combining estimated proton input, soil buffering capacity and the current pH of the soil, which identified the wheatbelt of WA as an area of high priority for action to address soil acidity (Wilson *et al.* 2009).

Historically, the management of soil acidity in agricultural soils has been achieved through the application of lime (Semple 1928). Lime continues to be an accepted practice for managing soil acidity (e.g. Johnston 2004) and is cost-effective in Australian agriculture (e.g. Cregan *et al*. 1989; Davies *et al.* 2006). Andrew and Gazey (2010) calculated that 11.8 million tonnes of agricultural lime was required in the central wheatbelt of WA over the next 10 years to raise the pH of the topsoil and subsurface soil above targets of

pHCaCl2 5.5 and pHCaCl2 4.8 respectively. Data from lime sales in WA suggest that lime use is well below this amount (Gazey 2009), indicating that there may be barriers to the use of lime by farmers in this region.

A focus group study was designed to provide preliminary information regarding any common barriers amongst farmers in the central agricultural area of WA to the adoption of liming as a practice to manage soil acidity. *A priori*, from anecdotal information, factors such as lack of knowledge of the status of pH on their farm (especially the subsurface), confusion regarding the best liming strategy, lack of recognition of the need for action to prevent yield loss, budgetary constraints, cost of transporting lime or some combination of these were identified as likely to be contributing to the under-utilisation of lime on farms. These hypothesised reasons were compared against the responses from the participants at these workshops.

Methods

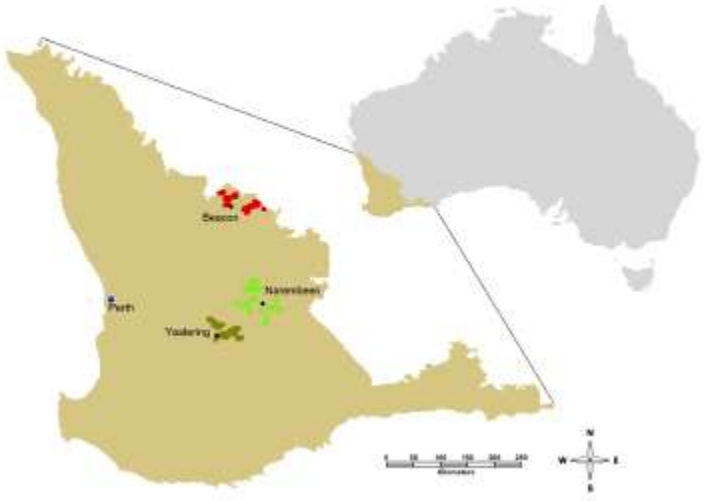

Figure 1. Map of the south-west agricultural area of Western Australia showing the towns where the three focus group workshops. The coloured dots around each town indicate the locations of soil sampling that had been carried out on the participants' farms. Perth, the capital city, is shown for reference.

Three focus group workshops were conducted between 3–5 August 2009 at Beacon, Narembeen and Yealering in the east of the central agricultural area of WA (Figure 1). Participants at each workshop were farmers from the surrounding district who had soil samples analysed as part of an incentive programme to encourage subsurface soil testing (Andrew 2009). A full report of the approach and outcomes of workshops is available at Fisher (2009).

Each workshop began with a presentation of the soil testing results for the central agricultural area and the local district and discussion of the results compared to the expectations of the participants. Participants were then asked a series of questions regarding their knowledge of targets for soil pH, their consideration of soil acidity as a problem and their previous lime use. For each question the quantitative response from each participant was recorded anonymously using the Turning Point Audience Response system which consists of a numeric keypad for recording a participant's response and software which records the responses and generates summaries (Keepad Interactive 2010). The pooled responses were presented to the participants in real time as a graph or table. Also, a written record of comments made during the discussion of the group responses, was anonymously produced.

The participants at each workshop identified up to ten key limitations to carrying out liming on their farm. These were ranked individually by each participant according to his/her perception of the importance of each. These rankings were then recorded anonymously using the Turning Point system. The ranking by each participant was weighted by the system such that the highest ranked limitation received a score of 10, the second highest 9 and so on down to the lowest ranked item which received a 1 or 2 depending on the number of limitations identified by the participants. The average weighted ranking for each limitation was displayed as a graph and the implications of this, particularly in terms of the type(s) and form(s) of information required were discussed with the group.

Results

A total of twenty-four participants were involved in the workshops, twenty-two males and two females. The participants were aged between 21 and 70 years. The proportions of participants in age ranges were 21–30 (21%), 31–40 (21%), 41–50 (38%), 51–60 (13%) and 61–70 (8%). Soil acidity was rated as 'somewhat of a problem' or 'widespread and limiting production' by 69% of the participants. It was considered 'likely to be a problem in the near future' by a further 13% of the participants. Only two participants rated it as 'not a problem at present' and the same number were unsure. Ninety-two percent of participants had applied lime previously. Limestone, dolomite, limesand and other liming products (e.g. burnt lime) had all been used at a typical application rate of 1 t/ha.

The participants varied in their individual ranking of the limitations, however aspects relating to the economics of farming and returns (e.g. cost, cash flow/available dollars, return on investment/certainty of return, certainty of response/variability of returns) were ranked highly by several participants at all three workshops and so received a high weighted rank (Figure 2). Other aspects related to decision-making and liming (which paddock to treat, priority of decision, how much to apply, unclear messages) were ranked as moderately important at Beacon and Narembeen. In contrast, for participants at the Yealering focus group, time constraints and additional aspects related to the economics of liming (freight, up front costs, economics of cropping) were ranked moderately important. The timing of liming (time of year), prioritisation of liming and other solutions such as acid tolerant varieties were not ranked highly by the participants. Interestingly, from the discussion, freight was not seen as a major limitation in its own right, but was considered to be part of the overall cost of the liming product. The cost of liming is considered by the farmers to be the overall cost including product, freight and spreading. It was also evident from these workshops that liming decisions are considered based on long-term benefits and so are treated completely differently from decisions related to short-term responses, such as nitrogen or herbicide application. Two broad groups of farmers with differing, though related information needs were identified in these workshops. One group can be classified as those who are largely convinced of the value of liming and are seeking to hone their inputs to maximise the returns from the application of lime. The second group of farmers were those who did not appear to be entirely convinced of the value of liming.

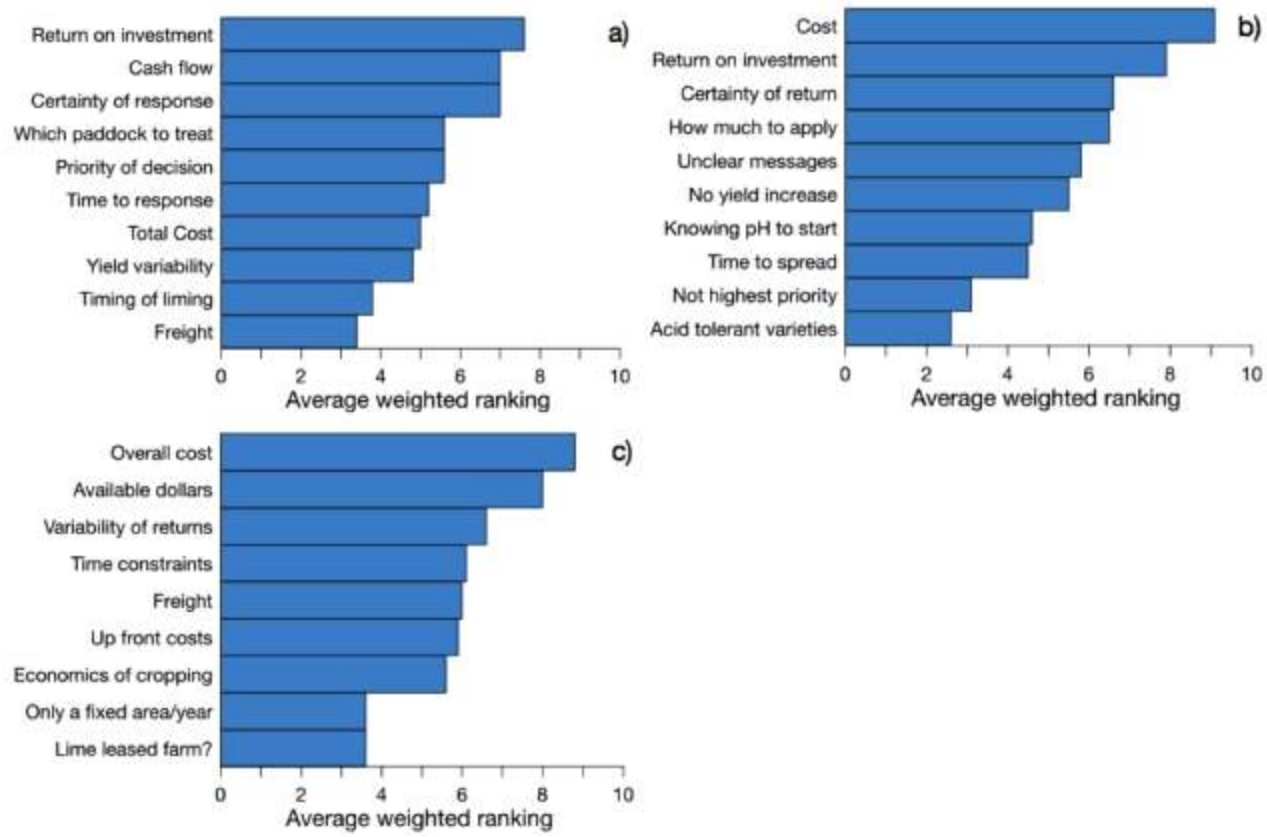

Figure 2. Ranking of limitations to liming by twenty-four participants at focus group workshops held at a) Beacon, b) Narembeen and c) Yealering. Limitations are shown in order from most important to least important.

Discussion and conclusion

Not surprisingly, aspects related to the economic realities of farming were the main limitations to liming identified by participants at these three workshops. This is in line with expectations prior to the workshops and with the literature. The cost of lime has been suggested as a potential constraint to its application in south-eastern Australia, particularly when yield responses are not seen for a number of years (Coventry 1992). Our results suggest that, for the participants at these workshops, more lime would be applied under conditions of better cash flow or farm profitability. However, the identification of two broad groups of farmers with differing, though related information needs is an important result which goes beyond the general finding of the importance of economic factors.

Farmers who are largely convinced of the value of liming have information needs regarding further clarification about responses to liming *in specific circumstances* and the rates required to achieve pH targets. The second group of farmers that did not appear to be entirely convinced of the value of liming, have information needs that fall into two broad categories. Firstly, fundamental information about acidity and liming, expected pH changes and the rates required to achieve pH changes at the paddock scale. Secondly, this group is also interested in improving the returns from liming and so would also be able to make use of any information about responses to liming, the rates required to achieve specific pH targets and the economics of liming. Future extension should target these two groups, particularly if the results from these focus group are found to be indicative of the larger population of farmers in WA.

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