



Roberts Evaluation Pty Ltd

Soil Health Baseline Survey

Goulburn Broken CMA

June 2012



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1 Background

The aim of the project *Building long term community commitment to providing ecosystem services from soil* (known commonly as the Beyond SoilCare project) is to build long-term farmer commitment to soil health and providing ecosystem services from soils. Farmers will have the opportunity to learn about the capability of their soils by learning about soil types and associated characteristics. Soil testing and interpretation skills will be developed through training workshops, field based activities and demonstration sites.

The objectives of the project are to:

1. Improve management practices for soil carbon and provision of associated ecosystem services on the riverine plains.
2. Improve management practices to ameliorate acid soils and improve perennial grass cover, composition and resilience in the Strathbogie Ranges.

The aim of the baseline study is to measure and document farmer attitudes and practices regarding soil management as at June 2012. The results will inform the project delivery in terms of understanding preferred methods of learning, and also form the baseline for assessing the impact of the project by comparing results to the follow up study to be conducted in 2013.

2 Methodology

2.1 Developing the questions

The questionnaire was developed in collaboration with staff from the Goulburn Broken CMA in order to capture the specific issues and to ensure appropriate wording. The questions are given in full in the section headings and/or the graph titles to show exactly what was being asked.

2.2 Data collection

Data were collected from landholders via an online survey. A link to the survey was sent out via email through a number of sources. This included CMA staff and Landcare facilitators. The survey was also advertised via soil health information. A PDF version of the questionnaire was also available to give the option of completing the questions on paper and faxing or mailing it in (no responses were received this way).

3 Results

Qualitative data were analysed by clustering comments into categories and recording how many were in each category. The categories were not predetermined but emerged from the data. Quantitative data were analysed in a spreadsheet (Microsoft Excel®) and initial correlations were run to explore relationships between variables.

The number of responses to each question declined for later questions; not all respondents answered all questions. The percentages reported below are for those who responded to the question, not the total number of respondents in the survey and the number of responses is specified. As indicated below, for most questions respondents could select as many options as applicable. As such, percentages do not add to 100 across the questions but indicate the proportion who selected that option compared to those who did not.

3.1 Property Size

The first question was answered by all 163 respondents. The minimum property size to be eligible for the survey was 10 acres. The first question checked this and the three people with property sizes of less than 10 acres were thanked for their time and told they were not eligible for the questionnaire.

Table 1. Property size (n=163).

What size is your property?		
Answer Options	Response Percent	Response Count
Less than 10 acres	1.8%	3
10 acres or more	98.2%	160

Of the 160 that had 10 acres or more, 154 gave the exact size. The figures for these are given in the table below.

	Hectares
Sum	3042
Average	200.11
Min	4.05
Max	2 23

3.2 What are the major soil issues?

Respondents were able to select as many issues as were relevant for them, and 150 respondents answered this question. The main issues regarding soil were fertility, acidity, and structure, all

selected by over 50% of respondents. The least selected were sodicity and salinity (under 10%). Erosion and carbon were chosen by less than one third of respondents.

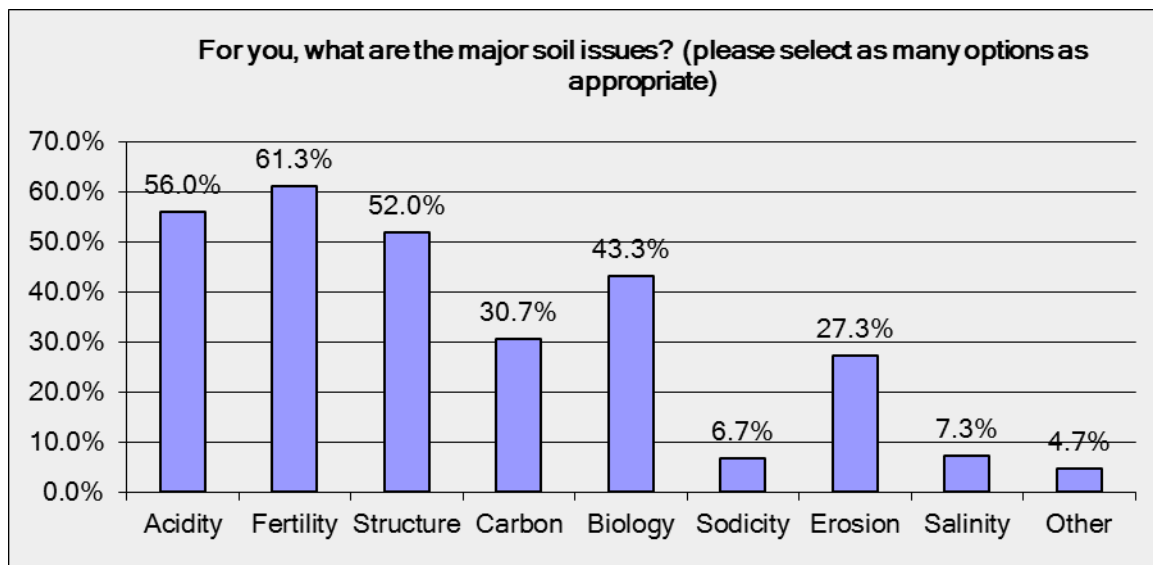


Figure 1. Major soil issues (n=150).

This question received 15 responses in the “other” category. Responses were diverse; however, two issues were referred to by more than one respondent: compaction (3 responses) and the importance of healthy soil (2 responses). It should be noted that the three respondents who added the response “compaction” had also indicated structure as a major issue.

The remaining issues were:

- The need to know how to remove bracken
- Poor microbial activity
- Pathogens in wet soil
- Shallow soil
- Steep slopes
- Bare patches

A number of respondents also indicated they did not know what their major soil issues were.

3.3 Information collection

The majority of the 154 respondents who answered this question had gathered some information on soils in their area (83.1%).

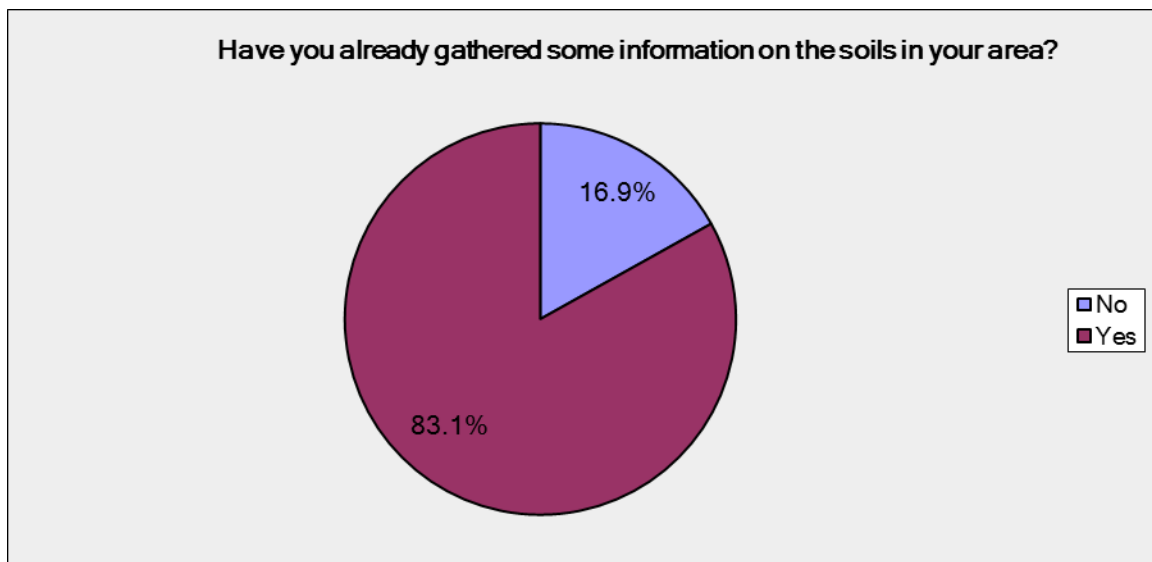


Figure 2. Respondents who had already gathered information on soils (n=154).

Of the 154 who responded to this question, 126 specified how they had gathered information. By far the most common method was via soil testing (92.9%). Around 50% of respondents selected field days or workshops; courses or whole farm plans; and production groups, Landcare groups, etc. This breakdown is presented in both the table and graph below. (See also Questions 3.4 and 3.7 for preferred sources of information.)

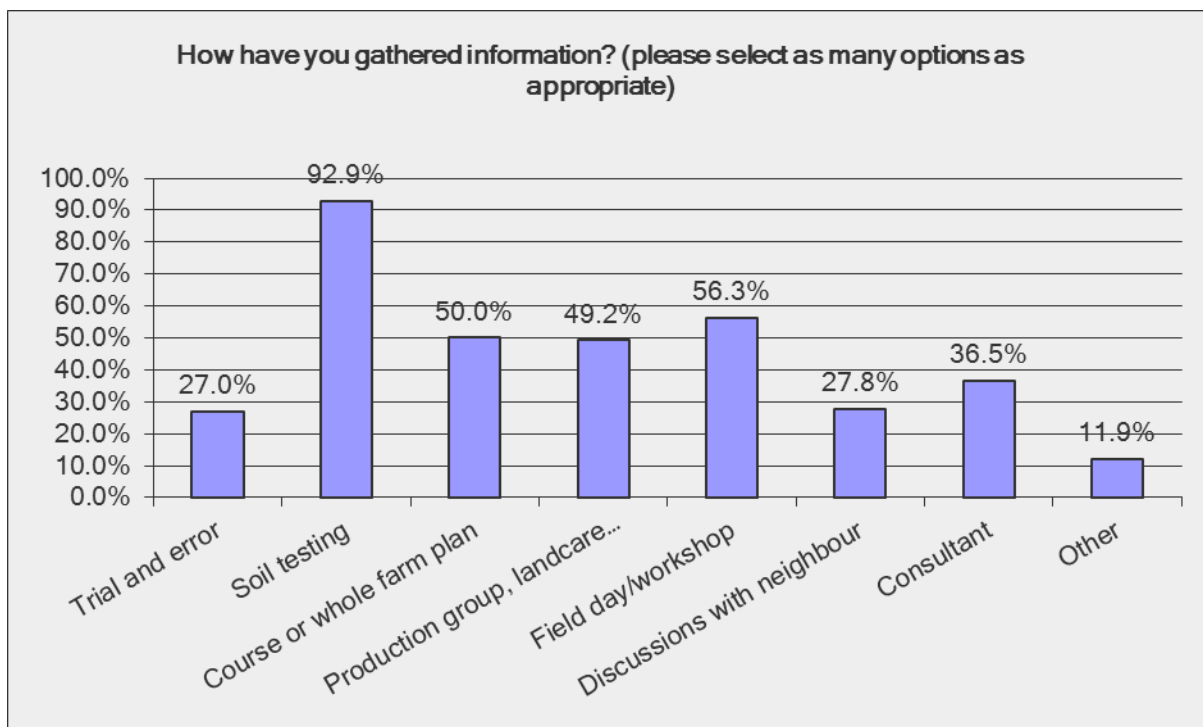


Figure 3. How information was gathered (n=126).

This question received 21 responses in the “other” category. A number of respondents indicated that they gathered information through books or literature (4 responses). Other common responses referred to self study, previous studies or online research (4 responses) and soil maps (3 responses). DPI information and staff were also listed in response to this question (3 responses). DPI was also a category in Question 3.4 below and was the most commonly chosen source of information.

The remaining references included:

- SWEPP testing
- Trials
- Property history
- Local Rodwells store
- Land Vic
- Hands on
- Observation
- Friends
- Farm planning
- Leaf tissue analysis
- Bio dynamic association
- Dookie College

3.4 Which people or groups do you rely on most for information about soil health and management?

A total of 147 respondents answered this question. The most common source chosen from the options given was DPI, followed by Landcare groups. Consultants and industry agronomists were the next most commonly chosen. Family was the least commonly chosen.

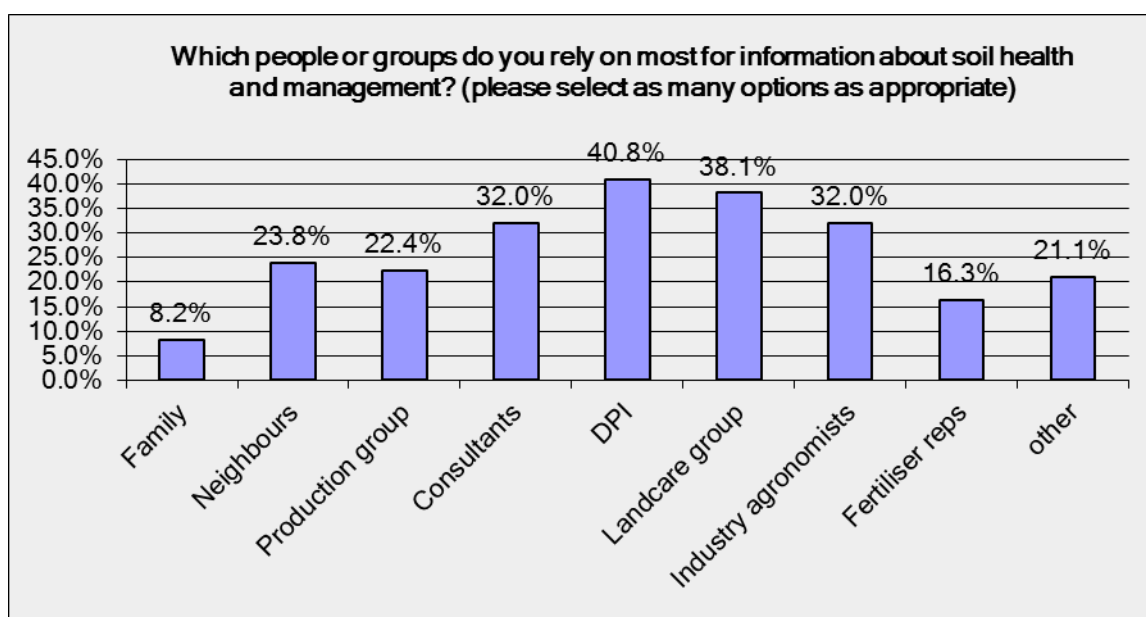


Figure 4. People or groups relied on for information (n=147).

This question received 35 responses in the “other” category. Question 3.7 also covers a number of the methods of learning that were raised here. A number of respondents indicated that they relied on books (9 responses) and reports or publications (4 responses). Courses and/or workshops were also mentioned multiple times (4 responses) as were own knowledge or previous study (3 responses), the internet (3 responses) and research bodies or not-for-profit advisory organisations (3 responses).

Remaining references included:

- Hands-on learning (2 responses)
- Friends, stock agents and shops (2 responses)
- Biological farmers (1 responses)
- CMA (1 response)
- DSE (1 response)
- Agronomist (1 response)
- Bio Dynamics (1 response)
- Natural farming sources (1 response)
- Soil tests (1 response)
- Multiple sources (1 response)

3.5 How much do you know about the following for managing your soils

Responses to this question were given a rating from “Nothing at all” (1) to “A lot” (5); 151 respondents answered this question. The average responses are given below, with 2.5 representing the mid point. From the table below it can be seen that most knowledge was in the areas of: erosion, soil testing and interpretation, fertility, and acidity. Sodicity was the only option below the mid point and carbon was just above. On the other hand, acidity, fertility and structure were the most common soil issues (see Section 3.2) and respondents indicate a higher level of knowledge about these issues.

It is important to note that the issue that respondents indicated they knew the least about (sodicity), was also the least likely to be listed as a major soil issue (see Section 3.2). This may be due to respondents’ lack of knowledge about this issue, or their lack of knowledge may be a result of it not being a major issue in their area. Only 10 respondents indicated that sodicity was a major issue for them. When looking at the responses of these 10 individuals only, the level of reported knowledge is higher (average of 3.2) than the average level of knowledge of sodicity for all respondents (2.4). For this group, the level of knowledge is similar to that for more common soil issues (although the low number of respondents in this category does reduce the reliability of the results).

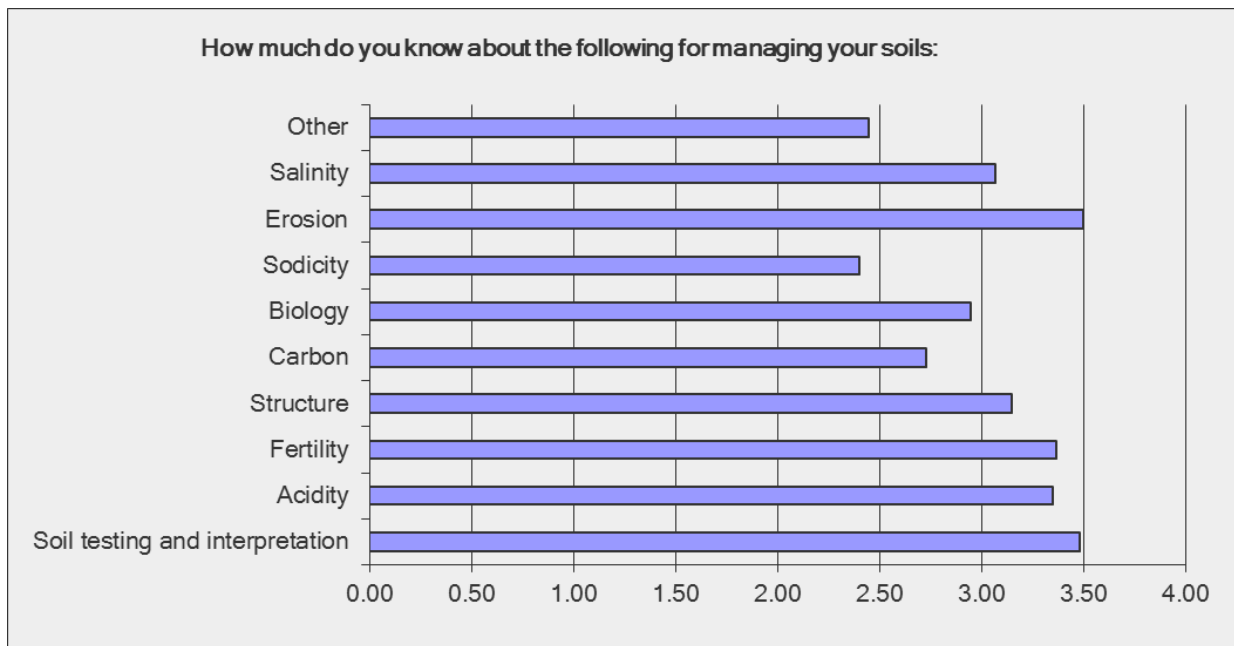


Figure 5. Level of knowledge about soil management techniques (n=151).

Only 6 respondents completed the “other” section for this question. Responses referred to:

- Ground cover (2 responses)
- Valuing weeds (1 response)
- Land class fencing (1 response)
- Natural techniques, such as biodynamic or organic (1 response)
- Tissue tests (1 response)

3.6 Do you think that soil testing is necessary for your property?

There was a very strong indication that respondents see soil testing as necessary. Respondents indicated how necessary they thought soil testing was on a scale of 1 (not at all) to 5 (completely). Of 151 respondents who answered this question, 112 (74.17%) rated the necessity of soil testing as 4 or 5, and only one respondent suggested that soil testing is “not at all” necessary (1). As noted above in Figure 3, most respondents had also conducted soil tests.

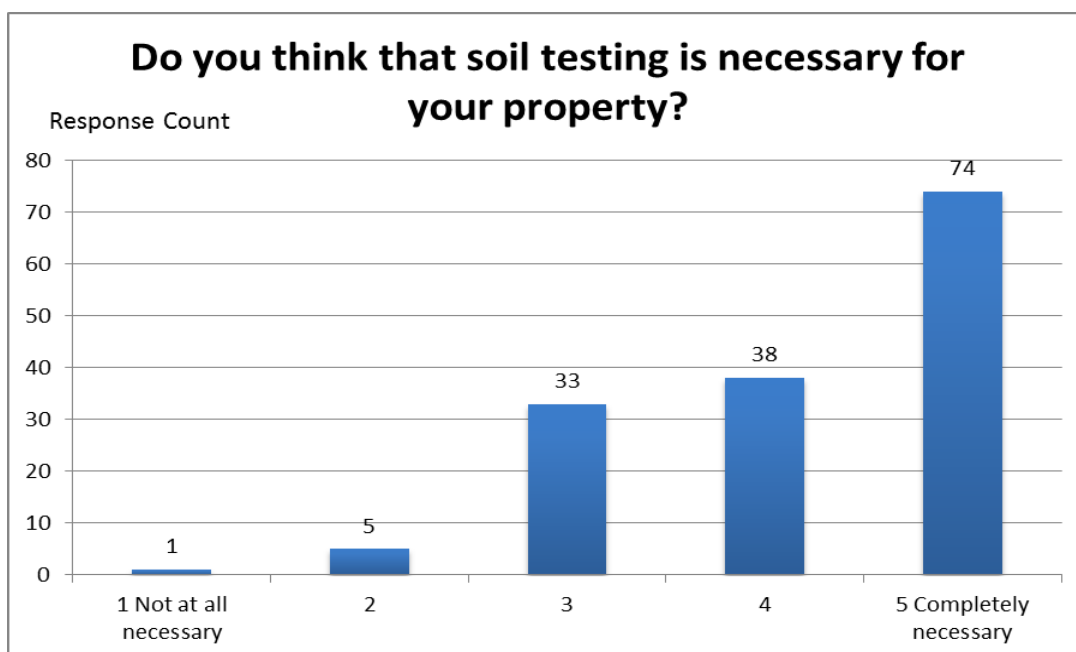


Figure 6. Respondents' ratings of necessity of soil testing on their property (n=151).

3.7 How do you prefer to learn about soils and their management?

Of 143 respondents who answered this question, a significant percentage indicated that their most preferred methods of learning included “doing it” (70.6%), field days (63.6%), and workshops (61.5%). Discussion groups and the internet were less popular methods of learning, chosen by 43.4% and 37.1% respectively. These responses indicate a preference for active involvement over passive types of learning. This preference is also reflected to some extent in responses to Questions 3.3 where soil testing was chosen as the most common method of gathering soil information.

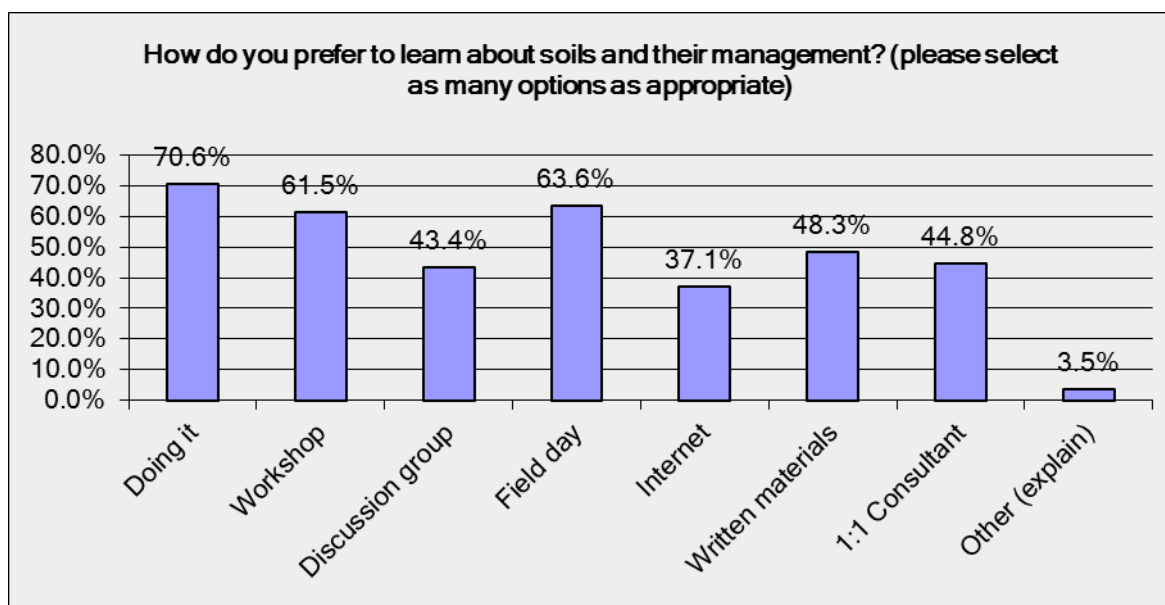


Figure 7. Preferred methods of learning about soils and their management (n=143).

This question received 11 responses in the “other” section. Responses referred to:

- Soil tests (2 responses)
- Women in Farming group (1 response)
- DPI extension officers (1 response)
- Multiple sources (1 response)
- Education (1 response)
- Knowledge sharing (1 response)
- Neighbours (1 response)
- Previous education (1 response)
- Quality and knowledgeable independent consultant (1 response)
- Quality and knowledgeable educator (1 response)
- Courses/workshops (1 response)

3.8 Why are you interested in learning more about the soils on your property?

This was phrased as an open ended question to allow for a full range of responses. In total, 128 people gave a response to this question. These responses were clustered into themes to give an understanding of the frequency of similar types of reasons for wanting to learn more about soils. These are arranged in order of most to least frequent, with the number in brackets indicating the number of times each overall theme was mentioned. Each response could be coded into multiple themes (e.g. productivity and sustainability).

Productivity & efficiency (40)

- improve production
- improve efficiency
- improve carrying capacity (stock)

Healthy plants, crops, pasture and stock feed (25)

- less weeds
- better/more stock feed
- healthy trees
- healthy natives

Sustainable production (13)

- sustainability

Improve overall farm health/essential to farming (12)

- soil health fundamental to everything
- holistic approach to overall farm health

Improve environmental outcomes (11)

- protect native bushland
- reduce carbon pollution
- enhance biodiversity

Healthy animals/stock (10)

- less disease
- minimising vet bills
- maximising stock price

Profitability & viability (10)

- long term profitability
- viability

Improve soil fertility & moisture holding capacity (10)

- improve soil fertility
- improve top soil
- improve moisture holding capacity

Healthy landscape (9)

- ground coverage
- general soil health
- general landscape health
- minimise erosion
- useable land

Improve knowledge about what to grow (5)

- learn about soil and plants
- learn about trees and natives

Improve knowledge about paddock management, soil, issues (5)

- learn about paddock management
- learn about soil management and monitoring
- learn about soil issues

Custodianship of the land-desire to improve land for the future (5)

- desire to improve land for future generations
- responsibility to care for the land

Improve organic farming (2)

- relationship between soil and organic

3.9 Do you undertake this practice?

A total of 143 respondents answered one or more of the options given in this question. As reported earlier, most respondents currently undertake soil testing. A majority also apply soil conditioners. The majority of other practices were evenly split, however deep ripping and the use of gypsum were the only practices with more people not undertaking them compared to those who were. This may in part reflect that deep ripping and the use of gypsum may only be thought of as relevant to respondents who indicated soil structure problems. However, when answers were filtered by those for whom soil structure was a major issue (78 respondents), 34.6% (27 respondents) used deep ripping and 44.9% (35 respondents) used gypsum. This indicates that take up of these practices were still relatively low even among those with relevant soil issues.

Table 2. Respondents undertaking soil management practices.

Do you undertake this practice?				
Answer Options	No	Yes	Response Count	% using this practice
Soil testing	25	117	142	82.3%
Applying soil conditioners (lime, etc)	39	104	143	71.3%
Deep ripping	96	41	137	29.9%
Gypsum	95	45	140	32.1%
Stubble retention	66	72	138	52.2%
Controlled trafficking	64	72	136	52.9%
Changed pasture	50	85	135	63.0%
Changed fertiliser regimes	51	85	136	62.5%

Respondents also rated how confident they were in using each of these on a scale of 1 (Not at all) to 5 (Very confident). In line with the results for current practices, soil testing and applying soil conditioners had the greatest number of respondents who were confident or very confident (4 and 5). Similarly, deep ripping and gypsum had a relatively low number of confident or very confident responses. Again, this may in part reflect the fact that only 78 respondents indicated that soil structure was a major issue. However, when responses were filtered by those for whom soil structure was a major issue, results still indicate some lack of confidence in using these practices (see Table 3 below).

Table 3. Respondents' confidence in using soil management practices.

How confident are you in using these?						Response Count
Answer Options	1 Not at all	2	3	4	5 Very confident	
Soil testing	8	10	35	39	41	133
Applying soil conditioners (lime, etc)	7	17	31	34	41	130
Deep ripping	32	21	29	18	12	112
Gypsum	22	18	29	26	15	110
Stubble retention	20	9	27	32	24	112
Controlled trafficking	26	5	31	23	29	114
Changed pasture	15	18	30	29	29	121
Changed fertiliser regimes	19	15	38	23	29	124

Table 4. Confidence of respondents with soil structure issues in using deep ripping and gypsum.

How confident are you in using deep ripping and gypsum, reported only those who indicated soil structure is a major issue.						
Answer Options	1 Not at all	2	3	4	5 Very confident	Response Count
Deep ripping	16	11	13	9	8	57
Gypsum	12	9	16	11	11	59

3.10 Are you planning on making changes to your soil management practices? Please describe the changes you plan to make in the following areas:

This was framed as an open ended question in response to each of the areas of soil management listed below. A total of 104 respondents answered the question in at least one of the listed areas. The responses given did not always refer specifically to intent to change practices. For example, some indicated that they would continue with a particular practice, that they would base future actions on testing or conditions, or it was not clear whether the practice was already undertaken. As such, the responses were coded to indicate a clear change and possible changes. Furthermore, some respondents indicated 'no' to each practice whereas others left it blank. The table below summarises the frequencies for each practice and then common themes are given for each practice.

Table 5. Number of respondents making a change or possible change in soil management practices (n=104).

Practices	Change	Possible change
Soil testing	43	11
Applying soil conditioners	34	14
Deep ripping	12	10
Gypsum	27	7
Stubble retention	16	10
Controlled trafficking	17	8
Changed pasture	37	16
Changed fertiliser regimes	27	23
Other	11	0

Soil testing

There were 83 responses to this question, with 43 respondents clearly indicating that they were going to make some change and a further 11 responses indicating a possible change.

Of these, responses most commonly referred to:

- More testing planned (15 responses)
- Regular testing and monitoring (13 responses)
- Unspecified change (5 responses)
- More frequent testing (5 responses)
- Commercial testing (4 responses).

The remaining responses referred to:

- Tissue or sap testing (2 responses)
- Testing a larger area (2 responses)
- More testing possible (1 response)
- Participation in a DPI project (1 response)
- Deep soil carbon testing (1 response)
- Change dependent on soil test results (1 response)
- Less testing (1 response)
- Seeking further assistance (1 response)

Applying soil conditioners

There were 77 responses to this question, with 34 respondents clearly indicating that they were making some change and a further 14 responses indicating possible change.

Of these, response most commonly referred to*:

- Change dependent on soil test results (15 responses)
- Lime (9 responses)
- Unspecified change (5 responses)
- Increase application (5 responses)

Other responses referred to:

- Change if needed (4 responses)
- Change dependent on finances/costs (4 responses)
- Compost (3 responses)
- Seeking organic solutions (3 responses)
- Considering alternative fertilizers (2 responses)
- Seeking specific improvement (2 responses)
- Worm castings (1 response)
- Annual application (1 response)
- Application as part of a broader program (1 response)
- Application more often (1 response)
- Biochar (1 response)
- Calcium (1 response)
- Correct timing of application (1 response)
- Increase biological inputs (1 response)
- Chook manure (1 response)
- Gypsum (1 response)
- Mushroom mulch (1 response)

- Planned checks (1 response)
- Possible change (1 response)
- Seeking further assistance (1 response)
- Some application planned (1 response)
- Super1 (1 response)
- *Response unclear (1 response)*

** Please note, some responses referred to more than one theme*

Deep ripping

There were 65 responses to this question, with 12 respondents clearly indicating that they were making some change and a further 10 responses indicating possible change.

Of these, responses most commonly referred to*:

- Undertaking/planning trials (8 responses)
- Planned ripping (4 responses)
- Unspecified change (3 responses)
- Change dependent on appropriate equipment (3 responses)

Other responses referred to:

- Increase ripping (2 responses)
- If needed (2 responses)
- Contoured land (2 responses)
- Aeration (2 responses)
- Seeking advice (1 response)
- Use of Yeomans plough (1 response)
- Tree planting (1 response)
- Change dependent on ability/capacity to undertake (1 response)

Gypsum

There were 66 responses to this question, with 27 respondents clearly indicating that they were making some change and a further 7 responses indicating possible change.

Of these, responses most commonly referred to*:

- Change dependent on soil test responses (6 responses)
- If needed (6 responses)
- Unspecified change (5 responses)
- Change possible (4 responses)

Other responses referred to:

- Change dependent on finances/costs (2 responses)

- On sulphur deficient paddocks (2 response)
- Some use planned (2 responses)
- Considering as an alternative (1 response)
- Improve soil fertility (1 response)
- Increase use (1 responses)
- Monitor past use (1 response)
- Planned to improve soil structure (1 response)
- Seeking advice (1 response)
- Seeking more information (1 response)
- Soil conditioner (1 response)
- *Response unclear (1 response)*

Stubble retention change

There were 66 responses to this question, with 16 respondents clearly indicating that they were making some change and a further 10 responses indicating possible change.

Of these, responses most commonly referred to*:

- Unspecified change (4 responses)
- Managing pasture height (2 responses)
- Undertaking/planning trials (2 responses)
- Mulching (2 responses)
- Retain more ground cover (2 responses)
- Retain organic matter (2 responses)
- Slashing (2 responses)
- If possible (2 responses)

Other responses referred to:

- Some change planned (1 response)
- Respondent did not know (1 response)
- Change dependent on strategy (1 response)
- Avoid overgrazing (1 response)
- Grass stubble (1 response)
- Change possible (1 response)
- If needed (1 responses)
- *Response unclear (2 responses)*

Controlled trafficking

There were 60 responses to this question, with 17 respondents clearly indicating that they were making some change and a further 8 responses indicating possible change.

Of these, responses most commonly referred to*:

- Tracks/laneways (7 responses)
- Unspecified change (4 responses)

- Rotational grazing (3 responses)
- More paddocks (2 responses))

Other responses referred to:

- Aeration (1 response)
- Fencing (1 response)
- Keep animals off the property (1 response)
- Manage grazing pressure (1 response)
- Managing traffic (1 response)
- Seeking advice (1 response)
- Seeking more information(1 response)
- Pasture rotation(1 response)
- Planned change (1 responses)
- “Veneered” (1 response)
- *Response Unclear (1 response)*

Changed pasture

There were 54 responses to this question, with 37 respondents clearly indicating that they were making some change and a further 16 responses indicating possible change.

Of these, responses most commonly referred to*:

- Species diversity (10 responses)
- Improve pasture (5 responses)
- More perennials (5 responses)
- Improve native grass management (5 response)

Other responses referred to:

- Dependent on finances/costs (4 responses)
- Dependent on soil test results (3 responses)
- Unspecified change (3 responses)
- Cell grazing (2 responses)
- Change grass varieties (2 response)
- Re-sowing (2 responses)
- Seeking more information/advice (3 responses)
- Undertaking/planning trials (2 responses)
- Dependent on weather (1 response)
- If needed (1 response)
- Improve pasture management (1 response)
- Irrigation (1 response)
- Less pasture (1 responses)
- Lessening acidity (1 response)
- Longer pasture (1 response)
- Maybe (1 response)

- Monitoring pasture (1 response)
- More cropping (1 response)
- Palatable grasses (1 response)
- Pasture cropping (1 response)
- Pasture rotation (1 response)
- Rye Grass (1 response)
- Lucerne (1 response)
- Weed management (1 response)

Changed fertilizer regimes

There were 74 responses to this question, with 27 respondents clearly indicating that they were making some change and a further 23 responses indicating possible change.

Of these, response most commonly referred to*:

- Dependent on soil test results (10 responses)
- More organic fertilizers
- Possible change (4 responses)
- Undertaking/planning trials (4 responses)
-

Other responses referred to:

- Chook manure (3 response)
- More natural methods (3 responses)
- Unspecified change (3 responses)
- Biological approach (2 responses)
- As/if needed (4 responses)
- Foliar fertilizer (2 responses)
- Seeking advice (1 response)
- Tissue testing (1 response)
- Trying to reach ideal levels (1 response)
- Evaluating need (1 response)
- Increase fertilizer (1 response)
- Dependent on finances/costs (1 response)
- Cease using (1 response)
- Humates (1 response)
- Conducting annual review (1 response)
- Probable change (1 response)
- Potassium (1 response)
- Rock phosphate (1 response)
- Considering alternatives (1 response)
- *Response Unclear (3 response)*

Other

There were 19 responses in the 'Other' category, with 11 respondents clearly indicating that they were making some change.

Of these, responses referred to:

- Keyline farming
- Research
- Stock management
- Worm tea
- Dung beetle colonies
- Slashing
- Grazing
- Organic fertilizer
- Foliar spray
- Rotational grazing

3.11 What are the major constraints to soil management for you?

A total of 54 respondents answered this question. From the three options given, financial constraints were the most frequently cited. A lack of knowledge was chosen by relatively few respondents. This could reflect the high level of knowledge of respondents in this sample or of landholders in this region in general. It should also be considered that there may be gaps in awareness.

It should be noted that this question had a relatively low response rate. Nonetheless, emphasis on time and cost constraints is worth noting.

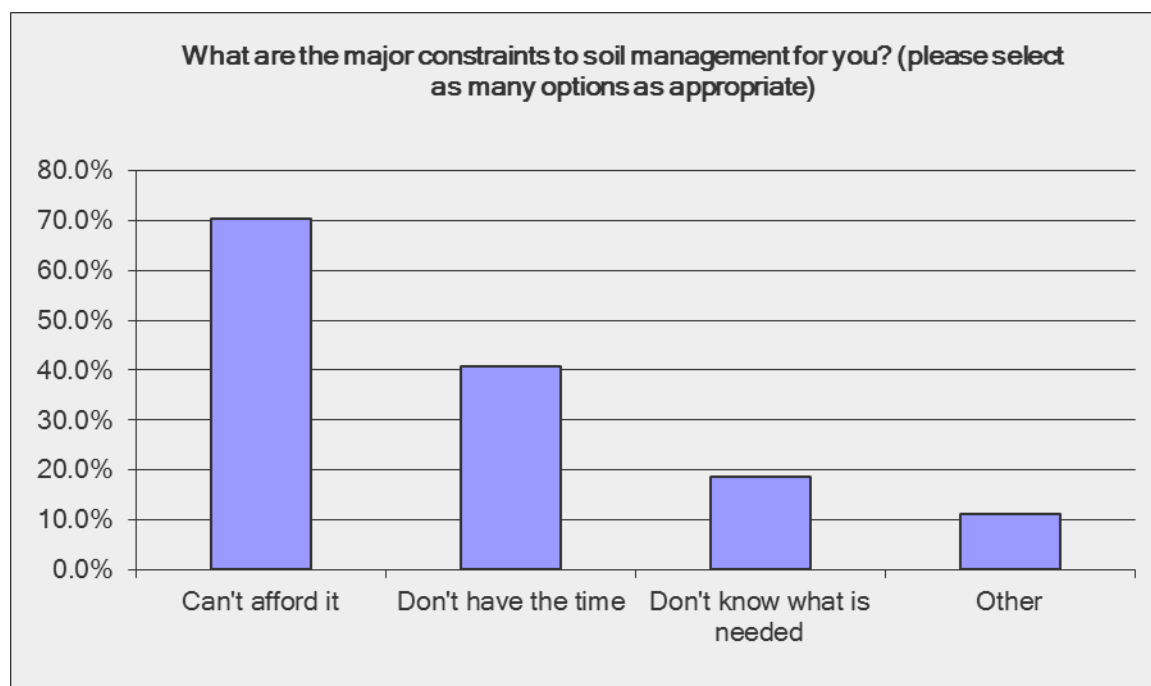


Figure 8. Major constraints to soil management (n=54).

This question received 15 responses in the “other” section. A number of responses referred to cost/lack of finances (4 responses), time constraints (3 responses) and lack of skills/knowledge (3 responses).

Remaining responses referred to:

- Lack of equipment (2 responses)
- Need to prioritise (2 responses)
- Need to remain productive
- Lack of support for new practices
- No constraints
- No desire

3.12 What will make it easier for you to trial something new that you have learnt?

In total, 59 people answered this question. Of the options given below, the most commonly chosen were ‘Doing a little bit of the change at a time’ and ‘Seeing it in the paddock’, each selected by 34 people. Again, these seem to be oriented towards actively doing it rather than talking or learning from others (see Questions 3.3 and 3.7).

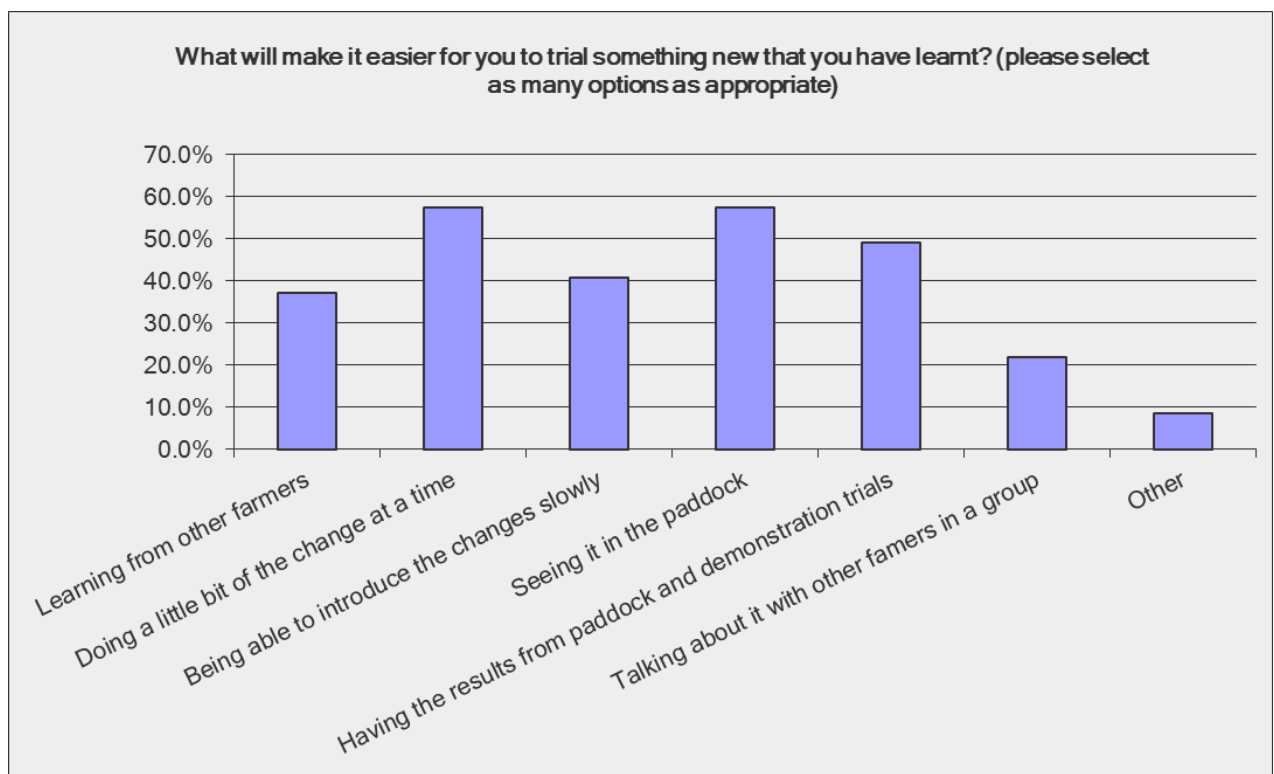


Figure 9. What makes it easier to trial something that has been learnt (n = 59).

Only 7 respondents completed the “other” section of this question. Responses referred to:

- Consultants (2 responses)
- Time
- Funds
- Ability to maintain production
- Ability to loan/share equipment
- Support
- Trials
- Field Days

As with the barriers, further knowledge was not nominated as one of the main priorities, although having the results of trials and seeing it in action was important.

3.13 Do you have any other comments to make?

The opportunity to make further comments was provided at the end of the questionnaire. This question received 13 responses. Two responses referred to being open to new learning/ideas/opportunities. The remainder of the responses were diverse, with the following themes receiving one mention each (some individual responses referred to more than one theme):

- Keyline designs/permaculture designs not eligible for grant funding
- Currently working well
- Farming is not livelihood
- Increased knowledge
- Changes made
- Need for support
- Importance of soil
- More extension officers needed
- Challenge of soil
- Survey design suggestion
- Lack of funds, equipment and knowledge
- Lack of water
- Cost of improvement outweighing benefits
- Structural problems
- Importance of native grasses
- Benefits of walking

4 Preliminary Conclusions

An impact study will be conducted to follow up on changes in the topics reported here. From the current results, there were a number of themes that emerged:

Current level of knowledge and practices

- There were some commonalities in areas of interest and knowledge. Soil acidity, fertility and structure were rated as the most important issues and were also scored high in terms of knowledge.
- Initial results suggest that current practices and knowledge are moderately correlated, but these are not related to intention to change soil management practices. For example, practices such as soil testing and applying soil conditioners had the greatest number of respondents who were confident and these were also the most used currently. While there were changes planned for these, respondents also planned to make changes to a number of other practices (e.g. pasture, fertiliser regimes).

Preferred methods of learning

- There were some common themes in methods of learning. 'Doing' or direct experience was generally preferred (e.g. soil testing). However, 'trial and error' as a distinct category was rated low as a means of gathering information, possibly due to misinterpretation of the term.
- Knowledge per se was not identified as a limiting or enabling factor.

Knowledge and practice change

There was a high level of knowledge in general and high rate of current use of some of the practices.

The impact study at the conclusion of the workshop series will measure the levels of knowledge of the different soil issues and practices and the range of practices being implemented and planned. This will allow an assessment of the degree of change that has taken place for those have participated in the project.