



Natural Resources Eyre Peninsula 'Farming Acid Soils Champions on Eyre Peninsula, 2019-2023'

PROJECT REPORT 2019-2020

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Contents

1. INTRODUCTION	4
2. OVERVIEW OF 'FARMING ACID SOILS CHAMPIONS ON EYRE PENINSULA' PROJECT ACTIVITIES 2019/20	5
3. CONTACTING LANDHOLDER PARTICIPANTS	5
4. WORKSHOP 1 - OVERVIEW OF SOIL ACIDITY CAUSES AND MANAGEMENT.	6
4.1 WORKSHOP 1. SUMMARY OF DISCUSSION	6
5. PARTICIPANT CASE STUDY PADDOCKS	7
5.1 MAPPING USING pH FIELD KIT	7
5.2 ESTIMATING SOIL ACIDIFICATION RATE USING 'LIME MAINTENANCE RATE CALCULATOR'.	7
6. WORKSHOP 2. pH MAPPING RESULTS, LIME MOVEMENT AND STRATIFICATION AND SOIL ACIDITY MODELS/DECISION SUPPORT TOOLS	8
7. PARTICIPANT FEEDBACK ON PROGRAM ACTIVITIES AND LEARNINGS	9
7.1 WORKSHOP 2. SUMMARY OF DISCUSSIONS	9
7.2 RESULTS OF PROGRAM FEEDBACK FORMS	9
8. SUMMARY AND CONCLUSIONS	11
9. REFERENCES AND FURTHER READING	12
9.1 REFERENCES	12
9.2 ABBREVIATIONS USED IN THIS REPORT	12
10. APPENDIX: FASC PROGRAM PARTICIPANT FEEDBACK	13

EXECUTIVE SUMMARY

Soil acidity is a significant issue on Lower Eyre Peninsula (LEP) and Eastern Eyre Peninsula (EEP) with more than 186,000 hectares of agricultural land in the region prone to acidification. Recent projects on Eyre Peninsula suggest that the rate of acidification is occurring faster on average than historical estimates. This report details the 2019/20 activities and results from the Natural Resources Eyre Peninsula (NREP) 'Farming Acid Soils Champions' project, supported by the NREP Regenerative Agriculture Program and funded by the Australian Government's National Landcare Program. The two main components of the project this year were;

1. Deliver the 'Farming Acid Soils Champions' program to landholders on Lower and Eastern Eyre Peninsula

2. Facilitate pH mapping activities.

Two groups were established in 2020 (one each in EEP and LEP). Workshop 1 of the program was held in at Cummins on Tuesday 25th February 2020 (15 participants from 13 farm businesses plus 3 local agronomists) and at Cleve the following day (8 participants from 6 farm businesses). Brett Masters (PIRSA) presented an overview of the causes of soil acidity and the impact of soil type and farming systems on acidification rates.

As part of this workshop participants were supplied with an aerial photograph of one of their paddocks and a field pH kit. Mary Crawford (NREP) led an exercise to show participants how they could use these to undertake 'low tech' soil pH mapping on their property to identify zones of varying soil pH within a paddock.

The second workshop in the program (held at Cleve on Tuesday 16th June 2020 and the following day at Cummins) gave landholders an opportunity to discuss their observations, what they had learnt about managing soil acidity, pH mapping results and what treatments they had implemented since the February workshop. Brett Masters (PIRSA) delivered a series of presentations including; discussion of the field mapping exercise results, case studies demonstrating the cost effectiveness of liming from pH mapping, summary of the 2020 surveillance sampling results, pH stratification under no-till and lime movement through the soil profile. PIRSA's excel based soil acidity management tools including the 'Lime Maintenance Rate Model', 'Lime Comparison' and 'Cost of soil acidity' tools were also demonstrated at this workshop.

Participants in the program found it interesting and relevant to their business and found the information presented valuable for understanding the causes, and monitoring the impacts, of soil acidity. Participants also gained skills to effectively treat soil acidity on their properties. Most participants responded that they would make changes to the management practices on their property as a result of the program including;

- Increased regular pH testing/paddock scale pH mapping;
- Apply variable rates of lime to target areas;
- Incorporation of lime into the subsurface by deep ripping or spading;
- Utilise excel based tools/models for management of acidity.

1. INTRODUCTION

A number of projects have been delivered on Lower Eyre Peninsula since 2010 looking to quantify acidification rates on Eyre Peninsula. Results from these projects indicate that under current farming practices and recent seasonal conditions acidification is happening faster than was historically estimated (Masters 2016). It is predicted that unless lime use rates are maintained over 21,000 tonnes per year that soil acidification will continue with a further 509,000 ha (19%) of agricultural land at risk (Forward and Hughes 2019). It is estimated that a further 216,000 tonnes lime is required to raise pH of acidic topsoils above 5.5 (CaCl_2).

Average lime use since 1999 is about 77% of the estimated topsoil acidification rate (21,000 tonnes for acid soils below 5.5 CaCl_2 and 35,000 tonnes for all acid prone soils), so a lime deficit has accumulated. A further 213,000 tonnes of lime is estimated to be needed to raise pH of acidic topsoils above 5.5 (CaCl_2) (Forward and Hughes 2019). However, increased lime sales in the region with estimated sales of 62,000 t in both 2018/19 and 2019/20 has started to reduce this deficit (Forward and Hughes, 2019 and Masters, 2020 unpublished).

In 2015/2016 and 2016-2018, in partnership with local farmer groups and with funding from the Department for Environment and Water (DEW), NREP supported two rounds of the 'Farming Acid Soils Champions' (FASC) program delivered by consultants from PIRSA Rural Solutions SA (Masters 2016 and Masters 2018). This program had the objective of developing the knowledge and skills of farmers on Lower Eyre Peninsula to champion the cause of managing acidic soils in the region.

With funding from the Australian Government's National Landcare Program (NLP) the FASC program was extended and delivered to groups of farmers at Cleve and Cummins in 2018/2019 (Masters 2019). Participant feedback from participants expressed that the program was interesting and valuable; and that it had resulted in an improved understanding of soil acidity and acidification rates. The majority of participants stated that they were intending to make changes to the management of soil acidity on their properties as a result of the program.

Due to the success of these programs a further project 'Farming Acid soils Champions on Eyre Peninsula 2019-2023' was funded through the NREP 'Regenerative Agriculture Program' with funding from the National Landcare Program (NLP). This report outlines the activities, results and outcomes during 2019/20.

2. OVERVIEW OF 'FARMING ACID SOILS CHAMPIONS ON EYRE PENINSULA' PROJECT ACTIVITIES 2019/20

The key objective of this project is to increase landholder awareness and knowledge of techniques and benefits of monitoring, maintaining and treating soil acidity. The project was carried out through a program of extension activities delivered to targeted groups of landholders in the priority 'existing' soil acidity districts (EEP and LEP).

The project consisted of two main components which were;

1. To deliver the 'Farming Acid Soils Champions' program to two new farmer groups (one each on Lower Eyre Peninsula and Eastern Eyre Peninsula).
2. pH mapping – provide participants with the knowledge and equipment to undertake pH mapping on their properties using aerial photos and pH field kits, and to offer them the opportunity to have a paddock mapped using a VERIS pH mapping machine.

3. CONTACTING LANDHOLDER PARTICIPANTS

Sarah Voumard, Regenerative Agriculture Project Officer (NREP) had discussions with local agronomists and Farming Systems Groups in the EEP and LEP districts to establish a list of potential FASC participants. She then contacted these landholders giving them an overview of the program and inviting them to participate. The key criteria for participating in the program was that;

- Participants were willing to 'champion' the cause of managing acid soils; sharing their knowledge and skills with other landholders in the district.
- Participants would commit to attending two workshops and participate in field mapping activities.

A large amount of potential participants were contacted (around 25 in Eastern Eyre Peninsula and 35 on Lower Eyre). As in 2018/2019 (Masters 2019) many of the landholders on Lower Eyre Peninsula who were contacted stated that they are either already liming due to discussions with their peers, or have recently been made aware of the soil acidity issue through their agricultural adviser and were formulating a treatment plan in consultation with them. Representatives of 13 farm businesses attended the first LEP workshop at Cummins (Tuesday 25th February 2020) and 6 farm businesses participated in the first Eastern Eyre workshop at Cleve (Wednesday 26th February 2020). There was an additional 13 farm businesses on LEP and 7 in EEP which initially expressed interest in the program but stated that they were not able to attend due to a lack of time this financial year, or withdrew from the first workshop because of competing commitments on the day of the workshop.

In previous rounds of the FASC program the compulsory requirement for participants to have at least one paddock mapped using an on-the-go mapping machine had caused some hindrance to participation in the program, particularly to those relatively new to understanding and managing soil acidity. With this in mind it was decided by the project team to offer this as a voluntary option rather than compulsory requirement for participants. The 'low tech' field pH mapping exercise using an aerial photo and field pH kit was enough to give participants an idea of pH variation within paddocks and presenting the results of some case study paddocks mapped using Veris machines at the second workshop adequately demonstrated some of the potential benefits of high resolution pH mapping for cost effective management of soil acidity.

4. WORKSHOP 1 - OVERVIEW OF SOIL ACIDITY CAUSES AND MANAGEMENT.

Workshop 1 of the program was held in at Cummins on Tuesday 25th February 2020 (15 participants from 13 farm businesses plus 3 local agronomists) and at Cleve the following day (8 participants from 6 farm businesses).

Brett Masters (PIRSA) presented an overview of the causes of soil acidity and the impact of soil type and farming systems on acidification rates. Mary Crawford (NREP) led a mapping exercise to show participants how they could use an aerial photograph and soil pH kit to identify zones of varying soil pH within a paddock. Workshop participants were asked if they were interested in undertaking mapping of their case study paddock by engaging the services of a commercial provider. At this time 2 participants on EEP and 3 in LEP felt they would be interested in this, with the remainder unsure (2 landholders on LEP and 1 on EEP ended up having paddocks mapped).

4.1 WORKSHOP 1. SUMMARY OF DISCUSSION

Key points from landholder discussions during this workshop are summarised below;

4.1.1 What is your experience of managing soil acidity?

At Cleve participants had some understanding that soils in the district are prone to acidification with some participants indicating that they are starting to see the impacts of this on crop growth, particularly in legumes such as lentils and vetch. One participant stated that he has a long term pH surveillance site located on his property, and sampling results indicate acidification at the site over the monitoring period. At Cummins about half (7) of the participants stated that they were new to managing acid soils and wanted to learn more. There were also a number who stated that they had done some liming in the past but wanted to update their knowledge regarding the causes, impacts and management of soil acidity, with some observing that they have seen production benefits following liming (either on their properties or neighbours properties), but that the effect of this seems to only last a few years.

4.1.2 What questions do you have that you would like answered through your participation in the 'Farming acid Soils Champions' program?

One of the key questions from participants in the first workshop was around the benefits of pH mapping, particularly on paddock with highly variable soil types. One participant was curious about how he could apply variable rates of lime to improve the effectiveness of liming if he didn't have access to a variable rate spreader. Several participants expressed interest in using yield maps or different crop types as indicators for soil acidity, with one wanting more information on the action and impact of aluminium toxicity on plant growth. Participants also wanted to learn more about subsurface acidity including the rate of lime movement through profile, and crop response from incorporating lime by deep ripping or spading. There was also one producer who wanted to know what the impact of lime applications was for livestock health.

4.1.3 What did you learn from the first workshop?

A discussion session was held at the end of the first workshop for participants to share what they had learnt from the sessions. At Cleve participants had been generally unaware of the impact nitrogen fertiliser applications had on soil acidification. However, there was a general agreement that soil acidification was an increasing issue in the district, and an understanding that surface acidity is relatively easy to treat but becomes more difficult as it the soil

becomes more acidic or if acidification begins to affect subsurface layers, with one participant stating that given current lime and freight costs applying lime to manage soil acidity is cheaper than the cost of other paddock inputs.

Most participants have ready access to lime spreaders (either owning or can easily hire one), and new models have improved capacity to spread the correct rates of lime more evenly. Some key messages that participants at the first Cummins workshop took away were about the different lime rates required to improve soil pH, for different soil textures, and about some of the different services that commercial mapping operators provide.

5. PARTICIPANT CASE STUDY PADDOCKS

5.1 MAPPING USING pH FIELD KIT

Prior to the first workshop participants were asked to select one paddock to use as a case study. Each participant was provided with a laminated aerial photograph of their paddock and a field pH kit. Participants were asked to use the knowledge gained about soil type influences on pH and indicator plants to determine areas of low pH in this paddock (Figure 1). They were then asked to map the paddock using the field pH kit to ground truth their expected pH variation.

Fourteen of the 19 farm businesses involved in the program (73%) undertook mapping using their field kit prior to end of the project. The growers who completed this said that it was a useful exercise, with a number commenting that some areas of the paddock were more acid or more alkaline than what they had thought.



Figure 1. Bartlett case study paddock with production zones and field pH results marked.

5.2 ESTIMATING SOIL ACIDIFICATION RATE USING 'LIME MAINTENANCE RATE CALCULATOR'.

Participants were also asked to provide the last five years of paddock management information (nitrogen fertiliser inputs and crop/pasture production) for the case study paddock. This information was entered into PIRSA's lime maintenance rate model to estimate the soil acidification which had occurred on the paddock over the five year period. A report summarising the pH status and acidification rate for their case study paddock was sent to each participant

The 'average' rotation, nitrogen fertiliser inputs and estimated acidification rate for the two districts (EEP and LEP) based on the paddock management information supplied by participants is summarised below (Table 1).

Table 1. Estimated acidification due to agricultural production amongst Eastern and Lower Eyre project participants.

DISTRICT	COMMON ROTATION	COMMON STARTER FERTILISER AND RATE	COMMON RATES OF N FERTILISER APPLIED IN SEASON	ESTIATED ACIDIFICATION RATE (SANDY LOAM)	ESTIMATED ACIDIFICATION RATE (CLAY LOAM)	APPLIED N FERTILISER CONTRIBUTION TO ANNUAL REPLACEMENT LIME REQUIREMENT - SANDY LOAM SOIL (%)	PRODUCT REMOVAL CONTRIBUTION TO ANNUAL REPLACEMENT LIME REQUIREMENT - SANDY LOAM SOIL (%)	LEGUME PRODUCTION CONTRIBUTION TO ANNUAL REPLACEMENT LIME REQUIREMENT - SANDY LOAM SOIL (%)
Eastern Eyre	Pasture or Grain Legume/Cereal /Cereal	70-80 kg/ha 27:12	0-50 kg/ha Urea	130 kg lime/ha /year	75 kg lime/ha /year	55%	27%	18%
Lower Eyre	Canola/Cereal/ Cereal/Grain legume	80-120 kg/ha 19:13	140-220 kg/ha Urea	290 kg lime/ha /year	110 kg lime/ha /year	60%	14%	26%

It was interesting to note that the information provided by participants reflected a higher proportion of LEP participants currently including a grain legume in their rotation, compared to in previous years (where a 3 year rotation of canola followed by two cereals was common). Under the more intensive canola and cereal rotation higher mineral nitrogen inputs resulted in even higher mean acidification rates for the districts (Masters 2016, Masters 2017, and Masters 2018). Due to higher rainfall on the LEP farmers are using much higher nitrogen rates compared to the EEP and therefore the acidification rate is much higher.

6. WORKSHOP 2. pH MAPPING RESULTS, LIME MOVEMENT AND STRATIFICATION AND SOIL ACIDITY MODELS/DECISION SUPPORT TOOLS

The second workshop in the program (held at Cleve on Tuesday 16th June 2020 and the following day at Cummins) gave landholders an opportunity to discuss their observations, what they had learnt about managing soil acidity, pH mapping results and what treatments they had implemented since the February workshop. Brett Masters (PIRSA) delivered a series of presentations including; discussion of the field mapping exercise results, case studies demonstrating the cost effectiveness of liming from pH mapping, summary of the 2020 surveillance sampling results, pH stratification under no-till and lime movement through the soil profile.

PIRSA's excel based soil acidity management tools including the 'Lime Maintenance Rate Model', 'Lime Comparison' and 'Cost of soil acidity' tools were also demonstrated at this workshop. In total, nine landholders and two agronomists attended (six at Cleve and five at Cummins). There was one program participant from EEP who was unable to make the second workshop due to other commitments. Unfortunately, ideal weather conditions for applying post emergent herbicides and spreading urea on the day the LEP workshop was scheduled saw many (10) participants withdraw from this workshop.

7. PARTICIPANT FEEDBACK ON PROGRAM ACTIVITIES AND LEARNINGS

Participant feedback was gathered via discussion sessions within the workshop and a through distribution of a written feedback form prior to the conclusion of the second workshop. In total nine feedback forms were returned (six from Cleve and three from Cummins). The feedback form was also emailed with a summary of the workshop slides to those participants unable to attend the second workshop, however none were returned.

7.1 WORKSHOP 2. SUMMARY OF DISCUSSIONS

Participants shared a range of experiences with managing soil acidity, as summarised below; ***What have you learnt about managing soil acidity since the February workshop?***

A number of participants at the Cleve workshops undertook soil testing pH for the first time on their property using the field pH kit. Most participants stated that the paddock mapping exercise using the field pH kits was useful and several participants indicated their intention to map several paddocks using this method each year. Additionally a couple of Cleve participants stated that they intended to engage a commercial operator to undertake higher resolution mapping of paddocks which they thought might have some area of acidic soils. A small number of participants had investigated the pH of their subsurface layers and were considering delving and deep ripping areas where problematic subsoil clays or rock did not present an issue.

Participants at the Cummins workshop stated that they better understood the impact of soil acidity, particularly on grain legume crops. One farmer (at Koppio) also considered that aluminium toxicity due to pH levels falling below 5.0 CaCl₂ was responsible for poor crop performance in many areas of his property and had observed better crop performance following liming as a result. Most LEP participants intend to undertake more soil pH testing and plan to lime at least a portion of the farm each year to improve legume productivity. They also stated that the results of mapping their case study paddocks were interesting, and that in a number of cases the map showed different soil pH values to what they had expected. One participant at Ungarra, who had some Veris® mapping done said that there was a good correlation between the pH map and crop yield on around 75% of paddock and that the pH mapping increased his confidence when making liming decisions. Another participant stated that they usually apply uniform lime rates across the paddock but, as a result of the program he can see value in using pH mapping to create variable rate lime prescription maps.

7.1.2 ***What do you want to get out of the day?***

Participants were asked what questions they wanted answered by the conclusion of the second workshop or 'What they wanted to get out of the day?' with responses including:

- Cost effective management of subsurface acidity;
- Would like to see a summary of the results of mapping and surveillance sampling;
- Discussion of the cost effectiveness of liming and financial impacts of liming;
- Discussion around effective testing for soil pH i.e. what depths and how often.

7.2 RESULTS OF PROGRAM FEEDBACK FORMS

7.2.1 ***Workshop relevance, interest and usefulness***

The feedback forms asked workshop participants to rate the 'Farming Acid Soil Champions' program in terms of;

- How relevant the workshop was to their business
- How interesting they found the workshop
- How useful/valuable they found the various components of the program.

The categorical scale of response was from the lowest (none then little) to the highest rating (some and very). There was also a 'not applicable' rating for participants who were not present for one or more of the project

activities. All participants who returned evaluation forms (9) reported that the content of the program was very relevant to their business, with 89% (8) stating that the workshop content was very interesting (and the remaining participant stating that he found the program content at least somewhat interesting). A full summary of the feedback responses can be found in the Appendix.

Participants were asked to assess the value of different components of the first (February 2020) workshop. All 9 stated that all components of the first and second workshops were of at least some value to their business with 68% stating that the overview and causes of acidity was very valuable to them. Additionally, 78% of respondents said that the information on treating soil acidity, and the presentation on how to use the field pH kit to map soil acidity was very valuable to them. All participants who provided feedback reported that mapping their paddocks using the pH field kit had at least some value to their business (with 86% finding this exercise very valuable).

Participants were asked how the program could be improved, with all participants who responded either stating that none of the content in the program needed changing or giving a 'nil response to this question. One participant said that he found the program structure (2 x 1/2 day workshops) to be useful, because it gave him time to go away and think about the information and do the paddock mapping exercise between workshops. Another participant stated that it was an excellent program and that more landholders in the district should be encouraged to participate, given increasing soil acidity in the district.

7.2.2 New/Key information for participants to take away from the program

There was a variety of take home messages that were considered new information to different participants. These included;

- Address soil acidity now before it becomes more difficult and costly to treat.
- 'Liming is still cheaper than spreading urea'
- Keep monitoring soil pH, particularly where indicator plants, particularly where weeds or poor crop performance indicate a soil acidity issue.
- Need to keep surface pH above 5.5 (CaCl_2) to reduce the risk of subsurface acidity developing.
- Importance of soil testing to pick up spatial variation in pH, which can increase the cost effectiveness and reduce the overall cost of the liming operation.
- Importance of incorporation for addressing subsurface acidity
- Demonstration of lime models/calculators were interesting.
- Cost of lost production

Participants were asked what they thought are the keys to 'doing liming right'? The key messages identified were;

- Use pH mapping to ensure the right rates of lime are applied to right areas (67%).
- Apply lime before it becomes a bigger issues/is more expensive to treat.
- Apply lime to address aluminium toxicity.

However there was a general acknowledgement that although most participants would like to spread more lime, in some years there is a financial constraint to doing so, particularly in the lower rainfall EEP where the cost of freighting lime from LEP adds significantly to the total cost of the liming operation.

7.2.3 Participant paddock management intentions

Four participants have applied some lime this year, with three (33% of participants) liming more than 50 ha. Four of those who responded felt that between 1% and 40% of their property is currently acidic (with additional areas prone to acidification), with another 4 participants indicating that 60 to 100 % of their property is currently acidic (mostly on LEP). When asked what proportion of the property participants intend to lime within the next 5 years, most said they would lime the entire area that they consider is acidic as well as applying maintenance rate of lime to address annual acidification.

Three participants said that they have applied lime in the past but need to begin liming again, with two participants saying that they applied lime for the first time in 2020. Another 2 participants said they have recently bought or are leasing new properties and applied lime to these in 2020 to manage soil acidity.

Six respondents said that they would definitely make changes to the way that they manage their property based on the information gained from the program, with the remaining participants stating that they would maybe make management changes as a result of the program. The most common management changes that participants thought they will make as a result of the program include;

- Increase regular pH testing/paddock scale pH mapping (67% of participants)
- Apply variable rates of lime to target areas (22% of participants)
- Incorporation of lime into the subsurface by deep ripping or spading
- Utilise excel based tools/models for management of acidity

The 'Maintenance Lime Replacement Model' and 'Lime Comparison Tool' were both demonstrated during the workshops. All participants thought that this had some value, with 77 to 89% finding the demonstration of these tools very valuable. Prior to the workshops most participants were unaware that these tools existed.

7.2.4 Unanswered questions or further information required

Through the feedback forms and group discussions participants were asked what their unanswered questions regarding managing soil acidity were. Around 67% gave a 'nil response' to this question, however the 3 questions that were raised following the workshops were;

- How to get lime into the subsurface most effectively in rocky soils
- Expected length of time before a response to liming is observed and how long the benefits from liming last.
- Future applications required to address acidification on their property.

There was also some discussion around the need for more local research/demonstration of the impact of nitrogen applications on acidification rates particularly with regard to;

- Nitrogen application timing
- Nitrate leaching and the potential for slow release nitrogen products
- Value of nitrogen fertiliser applications in wet (leaching year).

8. SUMMARY AND CONCLUSIONS

The workshop program provided participants with a good overview of the causes, pH monitoring and impacts of soil acidity, and demonstrated novel strategies for treating the issue through pH mapping activities and demonstration of excel based soil acidity management tools/models.

Most participants who submitted the program feedback found the workshops interesting and relevant to their business, and found all components of the program had at least some value to their business. Most participants also stated that they would make changes to the management of their property as a result of the program including;

- Increase regular pH testing/paddock scale pH mapping (67% of participants)
- Apply variable rates of lime to target areas (22% of participants)
- Incorporation of lime into the subsurface by deep ripping or spading
- Utilise excel based tools/models for management of acidity

However there are still some unanswered questions around effective treatment of subsurface acidity and the effectiveness of surface lime application to treat subsurface acidity in the region.

This project to date has provided a greater awareness and understanding of soil acidity and treatment throughout the LEP and EEP. The project will continue for another three years with different groups throughout the Lower and Eastern Eyre Peninsula.

9. REFERENCES AND FURTHER READING

9.1 REFERENCES

Forward, G. and Hughes, B (2019) 'Soil acidity status report for the Eyre Peninsula Natural Resources Management Region' DEW, September 2019.

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Masters, B. (2019) 'Restoring Soil pH balance in areas with existing soil acidity 2018-2019. Final Project Report, PIRSA. June 2019.

9.2 ABBREVIATIONS USED IN THIS REPORT

cm-	Centimetres
DEW-	Department for Environment and Water.
EP -	Eyre Peninsula
EEP -	Eastern Eyre Peninsula.
EPNRM -	Eyre Peninsula Natural Resources Management Board
FASC-	Farming Acid Soils Champions
ha-	hectares
LEP –	Lower Eyre Peninsula
mg/kg -	Milligrams per kilogram, a measure of analyte concentration in soil.
N-	Nitrogen
NLP-	National Landcare Program
NREP-	Natural Resources Eyre Peninsula
pH-	Potential hydrogen; a measure of soil acidity and alkalinity
pH(CaCl₂)-	pH in calcium chloride
PIRSA-	Primary Industries and Regions SA
t-	tonnes
t/ha -	tonnes per hectare

10. APPENDIX: FASC PROGRAM PARTICIPANT FEEDBACK

11 participants at second workshop in June 2020 (6 Cleve, 5 Cummins)

Feedback forms returned: 9 (82%)

Workshop content	None	Little	Some	Very	Total
How relevant to business	0	0	0	9	9
How interesting	0	0	1	8	9

Value of Workshop Content (FASC Workshop 1)	N/A	None	Little	Some	Very	Total
FASC Workshop 1. Overview of soil acidity		0	0	3	6	9
FASC workshop 1. Presentation on causes of soil acidity-soil		0	0	3	6	9
FASC workshop 1. Presentation on treatment of soil acidity - Lime		0	0	2	7	9
FASC workshop 1 pH mapping using field kit and aerial photo		0	0	2	7	9

Value of Program Activities 2 (Mapping and Combined Workshop)	N/A	None	Little	Some	Very	Total
Mapping activity: Paddock pH mapped using VERIS machine	0	0	0	1	8	9
Workshop 2: Overview of 2019 mapping results	0	0	0	1	8	9
Workshop session 2. Acidity tools- Lime replacement model	0	0	0	1	8	9
Workshop session 2. Acidity tools- Lime comparison tool	0	0	0	2	7	9
Workshop 2. Stratification and lime movement	0	0	0	1	8	9

What did you learn that was new?	# of participants
Address soil acidity now before issue becomes more difficult and costly to address.	3
Need to keep surface pH above 5.5 to reduce risk of subsurface acidification	1
Importance of testing to pick up spatial variation	2
Importance of incorporation for addressing subsurface acidity	1
Lime models/calculators were interesting	2

Will you be implementing changes as a result of today	No	Maybe	Probably	Yes	Total
# participants	0	3	0	6	9

What area of the program could be improved	# of participants
No answer/No improvement required	7
Better coffee	1
Good program - need to attract more participants	1

Lime history	N/A	0%	1-20%	21-40%	41-60%	61-80%	81-100%	Total
What proportion of your farm do you think is acidic ?	0	0	4	1	2	0	2	9
What proportion of your farm do you intend to lime over the next 5	0	0	2	5	1	0	1	9

	N/A	0 ha	1-50 ha	50-99 ha	100-199	200-299	>300 ha	
How much liming have you undertaken this year (ha)		5	1	1	0	1	1	9
How many ha did you have mapped with machine		8	0	0	0	1	0	9
How much mapping using field kit/soil tests		0	1	3	3	1	1	9

Reasons For Increased Liming	# participants
No liming undertaken yet- cost/cash flow	2
Bought/leasing new farm	2
Limed years ago-need to start reliming	3
Starting to see improvements from lime applications	2

Doing liming right	# participants
Use mapping to ensure right rates in right areas	6
Apply lime before becomes bigger issue/more expensive to address	1
Apply lime to address aluminium toxicity	1
No answer	1

Management techniques likely to implement	Yes
Increase regular pH testing/paddock scale pH mapping	5
Apply variable rates of lime to target areas	2
Liming + deep rip with inclusion plates to address subsurface acidity	1
Utilise excel based model for improving management of acidity	1

Further work required (unanswered questions)	# participants
No answer	6
How to get lime into the subsurface most effectively in rocky soils	1
Time before/length of response to lime applications	1
Future applications required to address acidification on their property	1

