Australian Government
Cotton Research and Development Corporation

FINAL REPORT 2014/2015

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: **CGA1505**

Project Title: Grower investigation of tools to manage soil compaction in irrigated cotton soils in the Gwydir Valley

Project Commencement Date: 01/07/2014 **Project Completion Date:** 30/06/2015

Part 2 – Contact Details

Administrator: Mrs Zara Lowien, Secretary Gwydir Valley CGA
Organisation: Gwydir Valley Cotton Growers Association
Postal Address: PO Box 824, Moree, NSW, 2400
Ph: 02 67 521 399 **Fax:** 02 67 521 499 **E-mail:** gwydircotton@gwydircotton.com.au

Part 3 – Final Report

Background

Cotton growers and consultants are becoming concerned with the level of compaction in soils in the Gwydir. The feeling is that compaction is increasing due in part to the use of round bale pickers and to working the soil when it is still above the plastic level at depth.

Compaction is believed to be impacting the productivity of the region. It is influencing crop growth, nutrition and water use and may be increasing water logging.

Soil pits dug as part of the Gwydir Valley area wide management groups at Ashley and Telleraga in July 2013 indicated that there was compaction on our irrigated cotton soils. Further pits dug in May 2014 confirm that soil compaction is not an isolated issue. Generally the cracking clay soils across the Gwydir Valley do repair themselves when they are able to have a series four or five wet and dry cycles. This project aims to look at possible remediation techniques which may benefit the soils.

Objectives

1. List the project objectives (from the application) and the extent to which these have been achieved.

The Objectives were;

- To increase the awareness and understanding of the compaction in irrigated cotton soils in the Gwydir Valley.
- To investigate possible crop rotations and mechanical approaches which may help reduce the degree of compaction in irrigated soil. This is seen as important in helping to achieve a more resilient and competitive cotton farming system and an environmentally sustainable cotton industry.

The March field day saw 24 growers and consultants attend; all were keen to see the differences in the soil pits between the five treatments. The trials identified the two most promising rotations for growers, safflower and irrigated wheat. It showed that the mechanical approach was successful, but only to the depth of ripping (30cm). Growers and consultants will be able to utilise this information as they develop practical rotations for their farming systems. A greater understanding of how to manage compaction will help achieve a more resilient and competitive cotton farming system and an environmentally sustainable cotton industry.

Methods

2. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related projects.

- ✓ Assess soil status through soil cores, soil strength (cone penetrometer), paint test and strip test. Scheduled to be conducted initially and again six to 12 months into the project to provide data and visual demonstrations for growers.
- ✓ Trial to be planted on the Australian Food and Fibre property Red Mill, north of Moree. The field has a long history of irrigated cropping. The grower has initiated the project and is keen to collect data to utilise in their farming systems.
- ✓ Plant rotation crops in trial plot; wheat, safflower and vetch.
- ✓ Complete mechanical deep ripping processes; targeted to wheel tracks and across whole field.
- ✓ Initial field day to highlight the level of compaction in irrigated cotton fields.
- ✓ Second field day in early 2015 to demonstrate the effectiveness of each of the treatments.
- ✓ Seasonal updates in Gwydir Valley CGA newsletter, the CottonInfo Gwydir Grower and local media.
- ✓ Summary report at the Gwydir Valley CGA AGM, CottonInfo season wrap up and agricultural media as well as a Final Report to CRDC.

Outcomes

3. Describe how the project's outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

- **The Project Outputs***:*

  - ✓ The trial increased the grower understanding of the importance of wetting and drying cycles at depth in the profile as a means to alleviate the impact of compaction.

  - ✓ The trial demonstrated that rotation crops differ in their ability to dry the profile to depth. It showed that safflower, irrigated wheat and then dryland wheat were practical rotation crops which may aid in managing soil compaction. Vetch has little impact on profile drying.

  - ✓ The trial demonstrated that ripping could be a valuable tool in the management of compaction, but that it was limited by the depth of ripping which was achieved. The depth of ripping will be impacted to some degree by the soil moisture at time of ripping. Growers need to assess soil moisture to below the depth of ripping and ensure that it is lower than the soils plastic limit; as determined by the rod test.

  - ✓ The trial increase grower ownership and involvement in research as it was a project initiated by growers in the Gwydir Valley and was supported and coordinated by the Gwydir Valley CGA in partnership with the local CottonInfo representative and CSIRO.

- **The Project Outcomes:**

  - ✓ The trial provided a commercial comparison of possible crop rotations and mechanical tools suitable to utilise to improve the sustainability of soils.
  - ✓ Growers now have more confidence to adopt changes in crop rotations aimed at alleviating soil compaction in irrigated cotton fields.

- **The Economic Benefits:** Increased productivity as a result of change management. Growers have more confidence in decision making to minimise and manage compaction which will help to improve root development, water infiltration and nutrient use efficiency.

- **The Environmental Benefits will be:** A more sustainable cotton production system.

- **The Social Benefits will be:** Growers working together to solve regional issues. Improved productivity benefits the whole community.

4. Results:-

a) Growers and consultants were asked if they wanted to have more soil compaction trials. 91% indicated they would.

b) Results are presented in the attached report written by Michael Braunack.

c) The while paint test was an interesting tool to include but there were inconsistencies due to the placement of the paint infiltrations sites. (photographs included).

d) Key learning:

(i) Soil strength increased to 0.2m under all treatments and then differences occurred.

(ii) The soil strength decreased to

i. 0.22m under vetch

ii. 0.25m ripped

iii. 0.3m under dryland wheat and

iv. 0.4m under irrigated wheat and safflower.

(iii) Below these depths the soil strength increased again to a depth of 0.6m, except for the ripped treatment. In the ripped treatment the soil strength decreased markedly at 0.25-0.3m, the depth of ripping.

(iv) The two treatments which dried the soil profile to depth were the safflower and the irrigated wheat.

e) There were 24 growers and consultants in attendance. There was good participation from all participants and lots of questions throughout the morning.

Budget

5. Describe how the project's budget was spent in comparison with the application budget. Outline any changes and provide justification.

The project has been conducted in accordance with budget expectations. The contribution from the grower has been more than budgeted.

Conclusion

6. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?

The trial provided a commercial comparison of possible crop rotations and mechanical tools suitable to utilise to manage soil compaction in irrigated cotton fields.

The commercial plots demonstrated that there were several crop rotations which could effectively dry down the soil profile. It showed that safflower, irrigated wheat and dryland wheat were practical rotation crops which may aid in managing soil compaction.

Through the project the Gwydir Valley CGA was able to show growers the impact of ripping the soil to alleviate compaction. Ripping can be a valuable tool to manage soil compaction; however the benefits of ripping are limited by the depth of ripping. Soil which are below the plastic limit at depth will be able to be ripped to a greater thus alleviating more soil compaction.

Extension Opportunities

7. Detail a plan for the activities or other steps that may be taken:
   (a) To tell other CGAs/growers/regions about your project.
   (b) To keep in touch with participants.

(c) For future projects.

A summary flyer is in production. This will be loaded onto the Gwydir Valley CGA website and will be available in hard copy to any cotton growers who request it.

The Gwydir Valley CGA will continue to host area wide grower group meetings and if requested will review the trial and support growers as they manage soil compaction.

Australian Government
Cotton Research and Development Corporation

Gwydir Valley Cotton Grower's Association Inc.

CottonInfo Information when you need it

Sustainable Soil Management

Gwydir Valley CGA Grass Roots Grant

Field Walk

Grower investigation of tools to manage soil compaction in irrigated cotton soils in the Gwydir Valley

Please join us
on
Thursday the 26th March 2015
at
Red Mill from 8:30am

During the morning we will look at soil pits and white paint tests of each of the four treatments in the CRDC funded project.

RSVP Tuesday 24th March 2015:

Alice Devlin	**or**	**Lou Gall**
0427 207 167		**0427 521 498**

Soil Pit observations Redmill 26 March 2015

Prepared by Michael Braunack

Ripped plot

Vetch plot

Safflower plot

Irrigated Wheat plot (left) / Dryland Wheat plot (right)

Site on 26 March 2015 (Dryland wheat, Irrigated Wheat, Safflower, Vetch and Ripped)

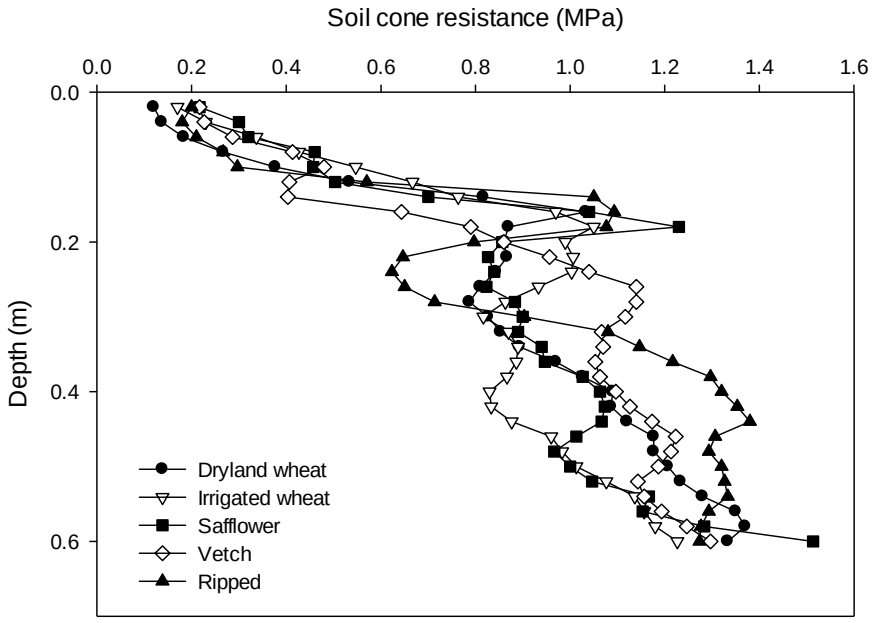


Figure 1. Soil cone resistance for each treatment 26 March 2015

A recording cone penetrometer was used to measure soil strength under each of the treatments on the assumption that the soil across all treatments was at a similar soil water content. This seemed reasonable from the observations made in the corresponding soil pits. Under all treatments the soil strength increased to 0.2 m and then treatment differences occurred, with strength decreasing to 0.3, 0.4 m under dryland wheat and irrigated wheat and safflower while strength decreased to 0.22 and 0.25 m under vetch and the ripped treatment (Fig 1). Below these depths soil strength again increased to 0.6 m under all treatments (Fig 1). The exception to this pattern was the ripped treatment where soil strength decreased markedly at 0.25-0.3 m, the depth of ripping (Fig 1).

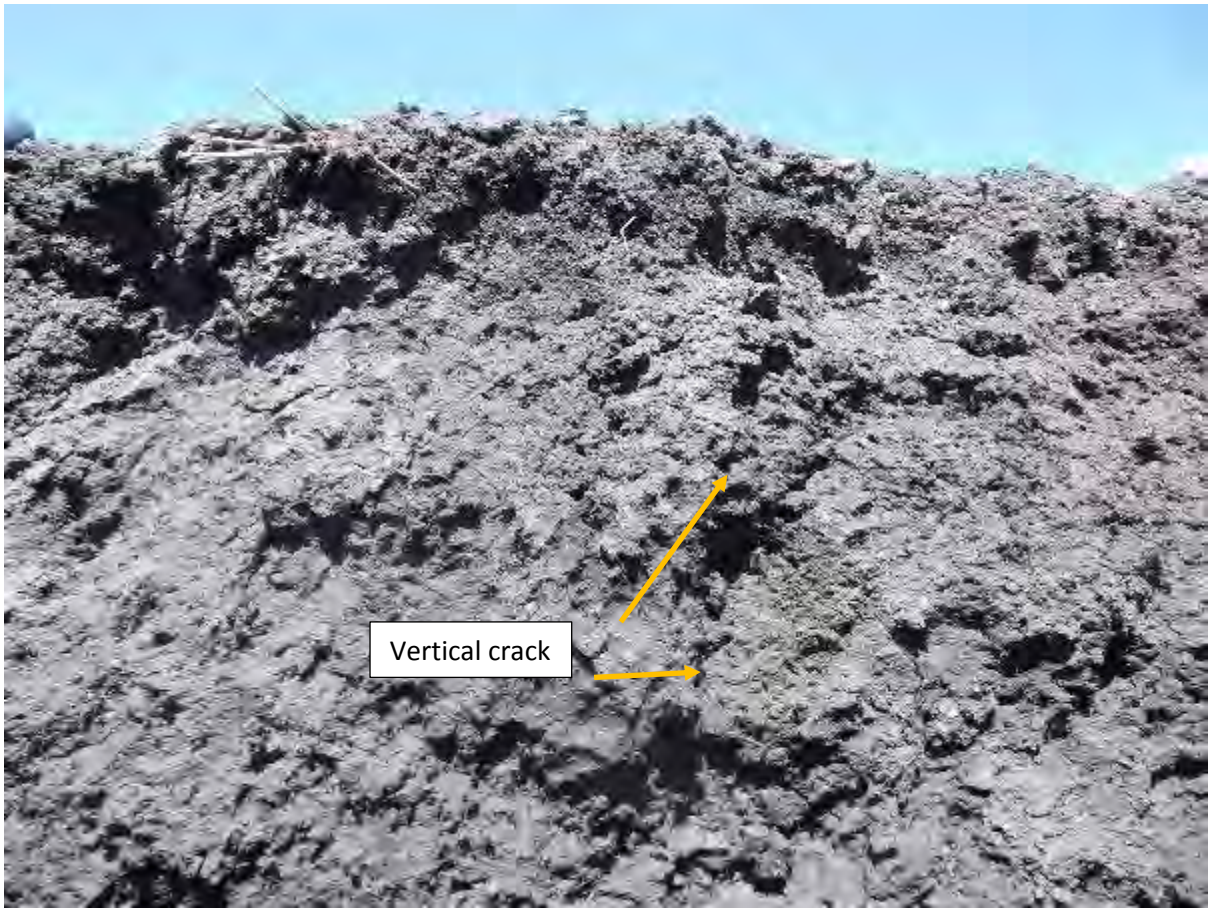
Table 1. Summary of observations in soil pits

Parameter	Ripped	Vetch	Safflower	Irrigated wheat	Dryland wheat
Soil surface	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.
Structure	Blocky & lenticular structure at depth indicates compression. Slickensides mid-pit indicates some wet/dry.	Blocky structure at depth indicates compaction. Aggregates lack porosity. Slickensides mid-pit indicates some wet/dry.	Angular aggregates at depth. Gypsum present mid pit.	Few slickensides. Large angular blocky aggregates at depth.	No slickensides, little wet/dry activity. Platy & blocky aggregates.
Profile moisture	Surface moist, wet at base of pit.	Wet throughout, red mottle at depth, water-logged?	Dry at top & base of pit, moist between.	Moist though depth of pit. Not as dry as safflower pit.	Wet surface & mid pit, moist at depth. Drier than ripped/vetch
Roots	No roots.	Mostly surface.	Roots through depth of pit.	Roots through depth of pit.	Roots surface and mid pit.
Other features	Vertical slot infilled with loose material.			Wheel tracks evident.	Wheel tracks evident.

The two treatments which dried the soil to depth were the safflower and irrigated wheat, with safflower being drier than the wheat (Table 1). The ripping loosened the soil to the depth of ripping with little change below this depth. Roots were evident to the base of the pits (1.0 m) under irrigated wheat and safflower, while under dryland wheat roots reached a depth of 0.3-0.4 m and under the vetch they were restricted to the immediate surface soil (0.1 m).

Ripped soil pit

Vetch soil pit



Safflower soil pit

Irrigated wheat soil pit

Dryland wheat soil pit

Results from several simple tests are given in tables below for each treatment, which can be used to assess sites over time to indicate changes in soil conditions.

SOIL HEALTH CARD RESULTS SHEET

Date: 26/3/2015 Location / management: Redmill Deep rip (draw a sketch map overleaf)

Soil Type: Vertosol Productivity: _____ Days since 20mm Rain: ____ Soil Moisture: dry / moist / water logged

RESULT► / TEST▼	POOR 1 ---- 2 ---- 3	FAIR 4 ---- 5 ---- 6	GOOD 7 ---- 8 ---- 9	TEST SCORES (1 - 9) 1	2	3	4	5	Av.
1. GROUND COVER	Less than 50% ground cover (ground plants or mulch)	50% to 75% ground cover (ground plants or mulch)	More than 75% ground cover (ground plants or mulch)	1	1	1	1	1	1
2. PENETROMETER	Wire probe will not penetrate.	Wire probe penetrates with difficulty to less than 20 cm.	Wire probe easily penetrates to 20 cm.	14	10	10	12	14	12
3. INFILTRATION	More than 7 minutes	3 to 7 minutes	Less than 3 minutes	4	4	4			4
4. DIVERSITY OF MACROLIFE	Fewer than two types of soil animals.	Two to five types of soil animals.	More than five types of soil animals.						
5. ROOT DEVELOPMENT	Few fine roots only found near the surface.	Some fine roots mostly near the surface.	Many fine roots throughout.	2	4				3
6. SOIL STRUCTURE	Mostly in clods or with a surface crust, few crumbs.	Some clods but also many 10 mm crumbs.	Friable, readily breaks into 10 mm crumbs.	2	4	4			3.3
7. AGGREGATE STABILITY 10 cm depth →	Aggregate broke apart in less than one minute.	Aggregate remained intact after one minute.	Aggregate remained intact after swirling.	1					
20 cm depth →				1					
8. EARTHWORMS	0 - 3	4 - 6	more than 6	0					
9. SOIL pH 5 cm depth →	pH 5 or lower	pH 5.5	pH 6 to pH 7	7					
20 cm depth →				7					
10. LEAF COLOUR	Stunted plants, leaf discolouration.	Some variation in growth and colour.	Appropriate leaf colour and uniform plant growth.						

NB Numbers resulting from the different tests are not intended to be combined to give an overall value of soil health.

Northern Rivers Soil Health Card

SOIL HEALTH CARD RESULTS SHEET

Date: 26/3/2015 Location / management: Redmill Vetch (draw a sketch map overleaf)

Soil Type: Vertosol Productivity: _____ Days since 20mm Rain: ____ Soil Moisture: dry / moist / water logged

RESULT► / TEST▼	POOR 1 ---- 2 ---- 3	FAIR 4 ---- 5 ---- 6	GOOD 7 ---- 8 ---- 9	TEST SCORES (1 - 9) 1	2	3	4	5	Av.
1. GROUND COVER	Less than 50% ground cover (ground plants or mulch)	50% to 75% ground cover (ground plants or mulch)	More than 75% ground cover (ground plants or mulch)	1	1	1	1	1	1
2. PENETROMETER	Wire probe will not penetrate.	Wire probe penetrates with difficulty to less than 20 cm.	Wire probe easily penetrates to 20 cm.	14	18	18	16	20	17.2
3. INFILTRATION	More than 7 minutes	3 to 7 minutes	Less than 3 minutes	7	7	8			7.3
4. DIVERSITY OF MACROLIFE	Fewer than two types of soil animals.	Two to five types of soil animals.	More than five types of soil animals.						
5. ROOT DEVELOPMENT	Few fine roots only found near the surface.	Some fine roots mostly near the surface.	Many fine roots throughout.	1	2	3			2
6. SOIL STRUCTURE	Mostly in clods or with a surface crust, few crumbs.	Some clods but also many 10 mm crumbs.	Friable, readily breaks into 10 mm crumbs.	1	3	5			3
7. AGGREGATE STABILITY 10 cm depth →	Aggregate broke apart in less than one minute.	Aggregate remained intact after one minute.	Aggregate remained intact after swirling.	2					
20 cm depth →				3					
8. EARTHWORMS	0 - 3	4 - 6	more than 6						
9. SOIL pH 5 cm depth →	pH 5 or lower	pH 5.5	pH 6 to pH 7	7					
20 cm depth →				7					
10. LEAF COLOUR	Stunted plants, leaf discolouration.	Some variation in growth and colour.	Appropriate leaf colour and uniform plant growth.						

NB Numbers resulting from the different tests are not intended to be combined to give an overall value of soil health.

SOIL HEALTH CARD RESULTS SHEET

Date: 26/3/2015 Location / management: Redmill Safflower (draw a sketch map overleaf)

Soil Type: Vertosol Productivity: _____ Days since 20mm Rain: ____ Soil Moisture: dry / moist / water logged

RESULT► / TEST▼	POOR 1 ---- 2 ---- 3	FAIR 4 ---- 5 ---- 6	GOOD 7 ---- 8 ---- 9	TEST SCORES (1 - 9) 1	2	3	4	5	Av.
1. GROUND COVER	Less than 50% ground cover (ground plants or mulch)	50% to 75% ground cover (ground plants or mulch)	More than 75% ground cover (ground plants or mulch)	1	1	1	1	1	1
2. PENETROMETER	Wire probe will not penetrate.	Wire probe penetrates with difficulty to less than 20 cm.	Wire probe easily penetrates to 20 cm.	14	16	20	17	16	16.6
3. INFILTRATION	More than 7 minutes	3 to 7 minutes	Less than 3 minutes	7	7	8			7.3
4. DIVERSITY OF MACROLIFE	Fewer than two types of soil animals.	Two to five types of soil animals.	More than five types of soil animals.						
5. ROOT DEVELOPMENT	Few fine roots only found near the surface.	Some fine roots mostly near the surface.	Many fine roots throughout.	7	8	9			8
6. SOIL STRUCTURE	Mostly in clods or with a surface crust, few crumbs.	Some clods but also many 10 mm crumbs.	Friable, readily breaks into 10 mm crumbs.	3	4	6			4.3
7. AGGREGATE STABILITY 10 cm depth →	Aggregate broke apart in less than one minute.	Aggregate remained intact after one minute.	Aggregate remained intact after swirling.	1	2	1			1.3
20 cm depth →				1	1	1			1
8. EARTHWORMS	0 - 3	4 - 6	more than 6						
9. SOIL pH 5 cm depth →	pH 5 or lower	pH 5.5	pH 6 to pH 7	7					
20 cm depth →				7					
10. LEAF COLOUR	Stunted plants, leaf discolouration.	Some variation in growth and colour.	Appropriate leaf colour and uniform plant growth.						

NB Numbers resulting from the different tests are not intended to be combined to give an overall value of soil health.

Northern Rivers Soil Health Card

SOIL HEALTH CARD RESULTS SHEET

Date: 26/3/2015 Location / management: Redmill Irrigated wheat (draw a sketch map overleaf)

Soil Type: Vertosol Productivity: _____ Days since 20mm Rain: ____ Soil Moisture: dry / moist / water logged

RESULT► / TEST▼	POOR 1 ---- 2 ---- 3	FAIR 4 ---- 5 ---- 6	GOOD 7 ---- 8 ---- 9	TEST SCORES (1 - 9) 1	2	3	4	5	Av.
1. GROUND COVER	Less than 50% ground cover (ground plants or mulch)	50% to 75% ground cover (ground plants or mulch)	More than 75% ground cover (ground plants or mulch)	1	1	1	1	1	1
2. PENETROMETER	Wire probe will not penetrate.	Wire probe penetrates with difficulty to less than 20 cm.	Wire probe easily penetrates to 20 cm.	18	16	16	18	16	16.8
3. INFILTRATION	More than 7 minutes	3 to 7 minutes	Less than 3 minutes	9	9	7			8.3
4. DIVERSITY OF MACROLIFE	Fewer than two types of soil animals.	Two to five types of soil animals.	More than five types of soil animals.						
5. ROOT DEVELOPMENT	Few fine roots only found near the surface.	Some fine roots mostly near the surface.	Many fine roots throughout.	4	5	6	7	8	6
6. SOIL STRUCTURE	Mostly in clods or with a surface crust, few crumbs.	Some clods but also many 10 mm crumbs.	Friable, readily breaks into 10 mm crumbs.	3					
7. AGGREGATE STABILITY 10 cm depth →	Aggregate broke apart in less than one minute.	Aggregate remained intact after one minute.	Aggregate remained intact after swirling.	2					
20 cm depth →				2					
8. EARTHWORMS	0 - 3	4 - 6	more than 6						
9. SOIL pH 5 cm depth →	pH 5 or lower	pH 5.5	pH 6 to pH 7	7					
20 cm depth →				7					
10. LEAF COLOUR	Stunted plants, leaf discolouration.	Some variation in growth and colour.	Appropriate leaf colour and uniform plant growth.						

NB Numbers resulting from the different tests are not intended to be combined to give an overall value of soil health.

SOIL HEALTH CARD RESULTS SHEET

Date: 26/3/2015 Location / management: Redmill Dryland Wheat (draw a sketch map overleaf)

Soil Type: Vertosol Productivity: _____ Days since 20mm Rain: ____ Soil Moisture: dry / moist / water logged

RESULT► / TEST▼	POOR 1 ---------- 2 ---------- 3	FAIR 4 ---------- 5 ---------- 6	GOOD 7 ---------- 8 ---------- 9	TEST SCORES (1 - 9) 1	2	3	4	5	Av.
1. GROUND COVER	Less than 50% ground cover (ground plants or mulch)	50% to 75% ground cover (ground plants or mulch)	More than 75% ground cover (ground plants or mulch)	1	1	1	1	1	1
2. PENETROMETER	Wire probe will not penetrate.	Wire probe penetrates with difficulty to less than 20 cm.	Wire probe easily penetrates to 20 cm.	18	12	18	12	14	14.8
3. INFILTRATION	More than 7 minutes	3 to 7 minutes	Less than 3 minutes	7	8	9			8
4. DIVERSITY OF MACROLIFE	Fewer than two types of soil animals.	Two to five types of soil animals.	More than five types of soil animals.						
5. ROOT DEVELOPMENT	Few fine roots only found near the surface.	Some fine roots mostly near the surface.	Many fine roots throughout.	2	4	7			4.3
6. SOIL STRUCTURE	Mostly in clods or with a surface crust, few crumbs.	Some clods but also many 10 mm crumbs.	Friable, readily breaks into 10 mm crumbs.	3	5	7			5
7. AGGREGATE STABILITY 10 cm depth →	Aggregate broke apart in less than one minute.	Aggregate remained intact after one minute.	Aggregate remained intact after swirling.	3					
20 cm depth →				3					
8. EARTHWORMS	0 - 3	4 - 6	more than 6						
9. SOIL pH 5 cm depth →	pH 5 or lower	pH 5.5	pH 6 to pH 7	7					
20 cm depth →				7					
10. LEAF COLOUR	Stunted plants, leaf discolouration.	Some variation in growth and colour.	Appropriate leaf colour and uniform plant growth.						

NB Numbers resulting from the different tests are not intended to be combined to give an overall value of soil health.

Location: Redmill Dryland Wheat Trial

Owner: AFF-Redmill.

Last Reading : 238.2 mm at 16-12-14 04:00:53

Default Usage (mm/day):

Default Irrigation Date: 16-12-2014

Current Usage (mm/day): -0.3

Current Use Irrigation Date: 01-04-2015

Save Changes

Current

(238.2 mm)

Full Point (mm): 310

Set Full Point to Current

Refill Point (mm): 270

Set Refill Point to Current

Rainfall

0 mm in last hour

0 mm in last 6 hours

0 mm in last 24 hours

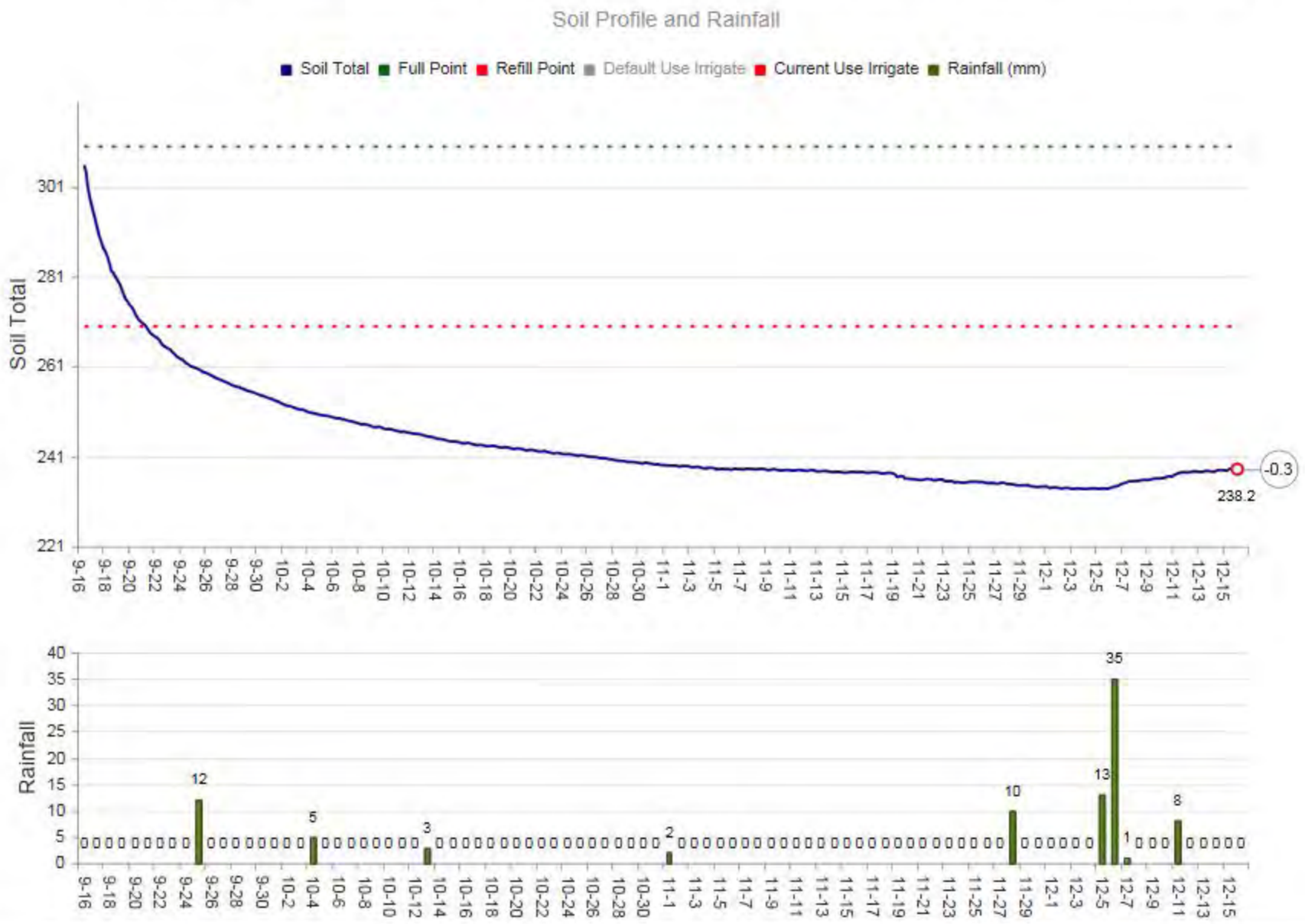
0 mm in last 48 hours

8 mm in last 7 days

67 mm in last 30 days

89 mm in last 365 days

Show Zoom | Show Default Usage Irrigate | Hide Current Usage Irrigate | Show Daily Usage | Show Notes | Historical Reporting



Location: Redmill Irrigated Wheat Trial

Owner: AFF-Redmill.

Last Reading : 251.3 mm at 16-12-14 04:00:53

Default Usage (mm/day):

Default Irrigation Date: 16-12-2014

Current Usage (mm/day): -0.3

Current Use Irrigation Date: 16-02-2015

Save Changes

Current

(251.3 mm)

Full Point (mm): 310

Set Full Point to Current

Refill Point (mm): 270

Set Refill Point to Current

Rainfall

0 mm in last hour

0 mm in last 6 hours

0 mm in last 24 hours

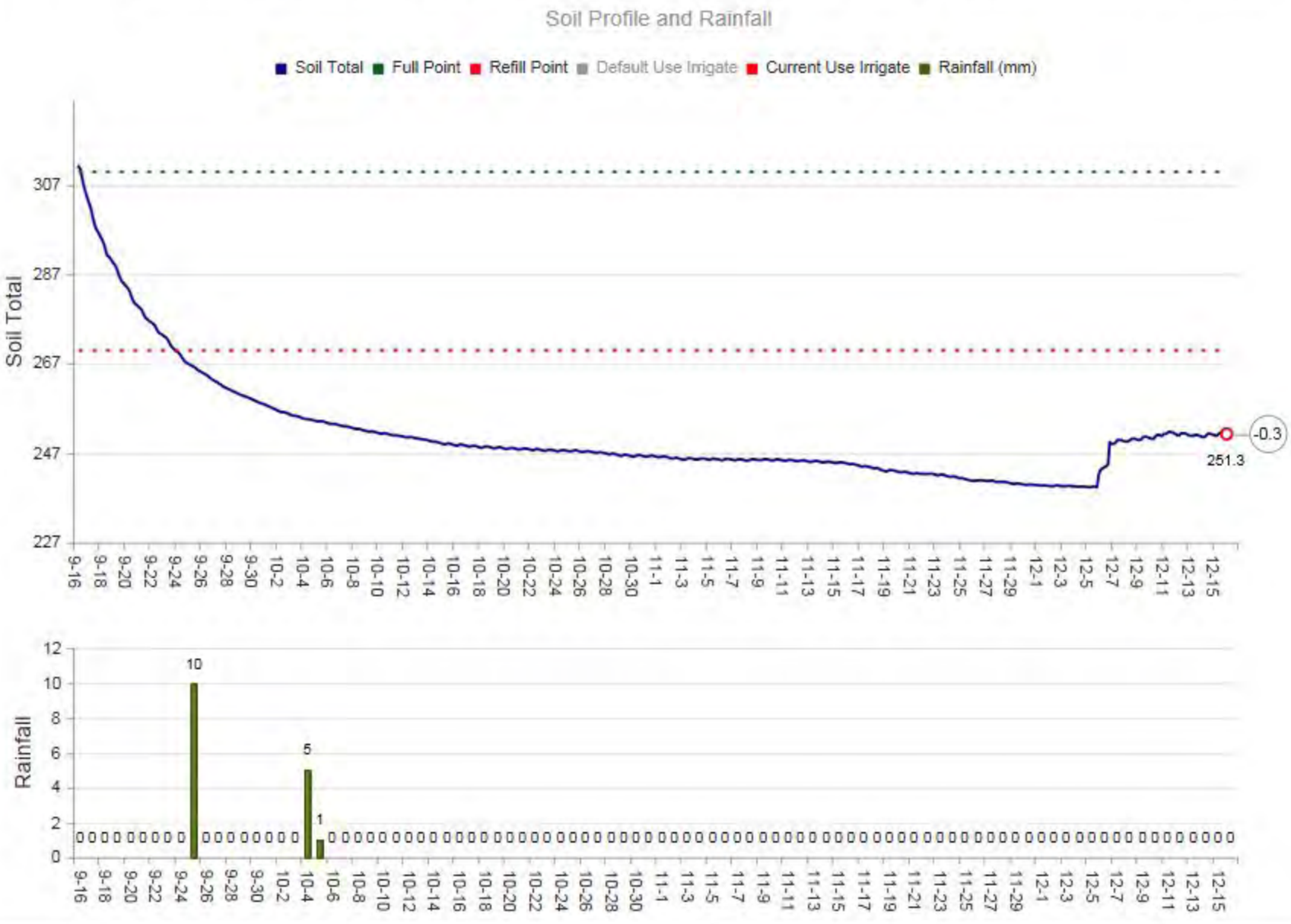
0 mm in last 48 hours

0 mm in last 7 days

0 mm in last 30 days

16 mm in last 365 days

Show Zoom | Show Default Usage Irrigate | Hide Current Usage Irrigate | Show Daily Usage | Show Notes | Historical Reporting



Current

(240.6 mm)

Location: Redmill Irrigated Safflower Trial

Owner: AFF-Redmill.

Last Reading : 240.6 mm at 16-12-14 04:00:52

Default Usage (mm/day):

Default Irrigation Date: 16-12-2014

Current Usage (mm/day): -0.1

Current Use Irrigation Date: 06-10-2015

Save Changes

Full Point (mm): 310

Set Full Point to Current

Refill Point (mm): 270

Set Refill Point to Current

Rainfall

0 mm in last hour

0 mm in last 6 hours

0 mm in last 24 hours

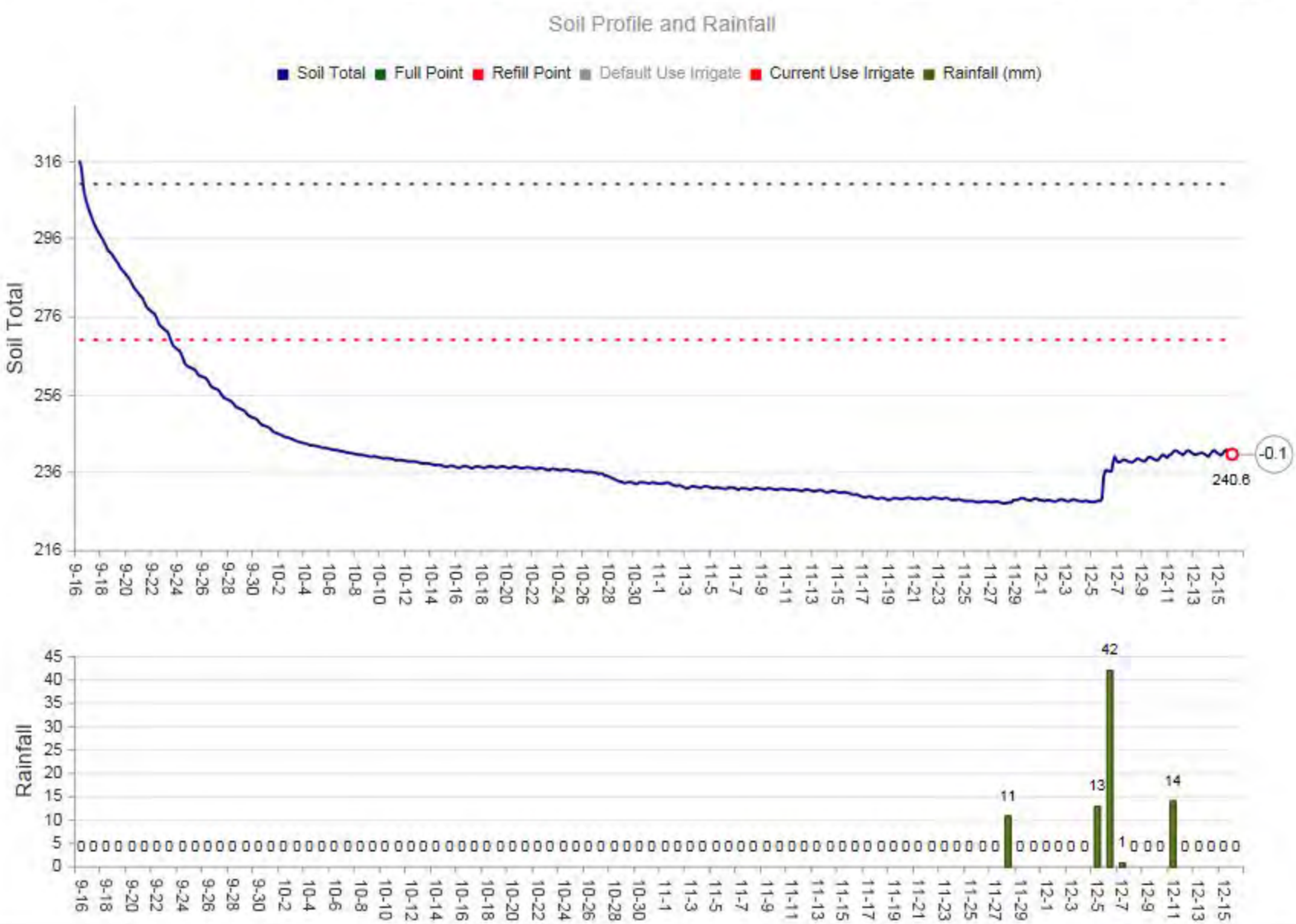
0 mm in last 48 hours

14 mm in last 7 days

81 mm in last 30 days

81 mm in last 365 days

Show Zoom | Show Default Usage Irrigate | Hide Current Usage Irrigate | Show Daily Usage | Show Notes | Historical Reporting



Location: Redmill Irrigated Vetch Trial

Owner: AFF-Redmill.

Last Reading : 265.7 mm at 16-12-14 04:00:53

Default Usage (mm/day):

Default Irrigation Date: 16-12-2014

Current Usage (mm/day): -0.4

Current Use Irrigation Date:26-12-2014

Save Changes

Current

(265.7 mm)

Full Point (mm): 310

Set Full Point to Current

Refill Point (mm): 270

Set Refill Point to Current

Rainfall

0 mm in last hour

0 mm in last 6 hours

0 mm in last 24 hours

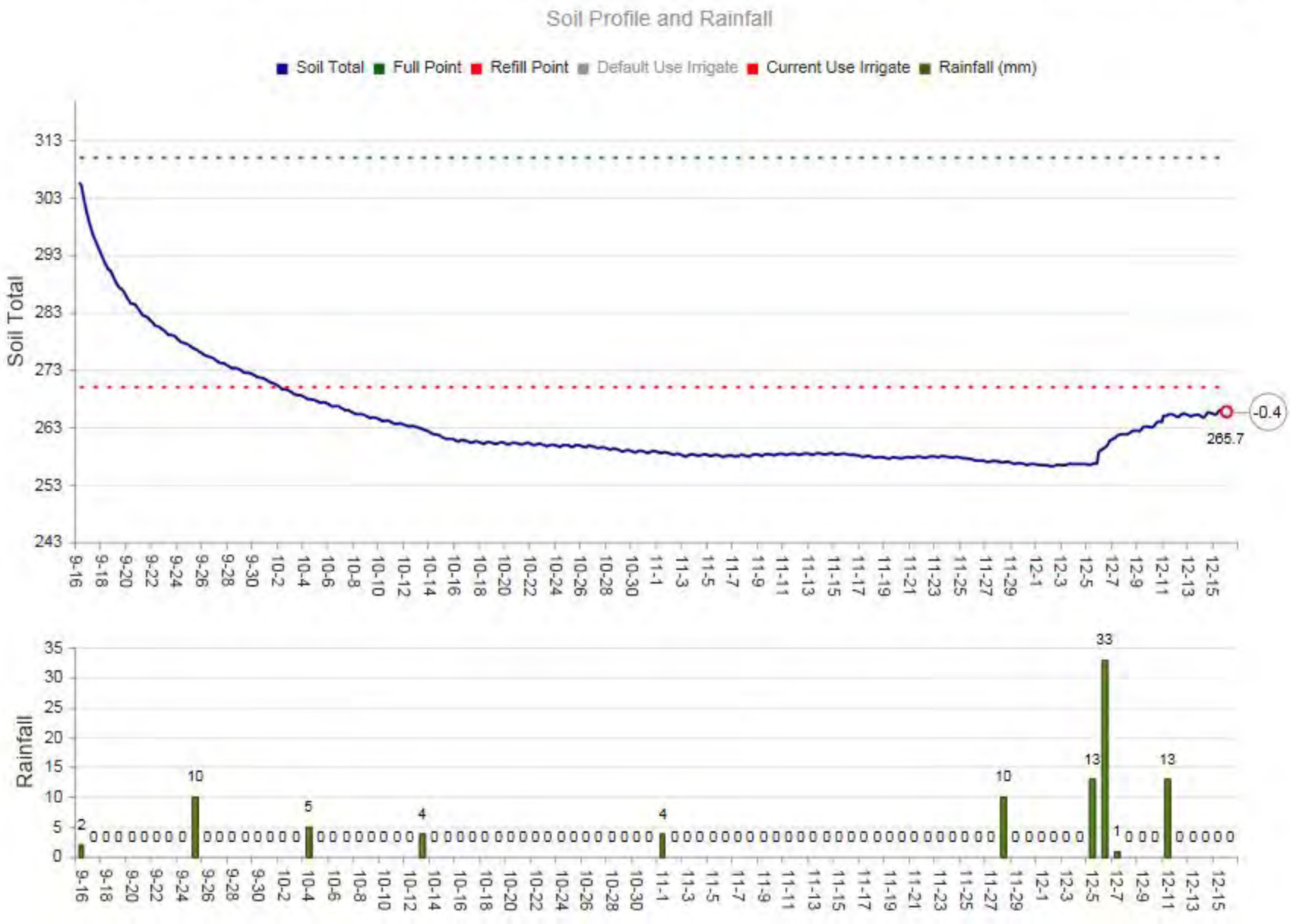
0 mm in last 48 hours

13 mm in last 7 days

70 mm in last 30 days

95 mm in last 365 days

Show Zoom | Show Default Usage Irrigate | Hide Current Usage Irrigate | Show Daily Usage | Show Notes | Historical Reporting



Location: Redmill Dryland Mechanical Trial

Owner: AFF-Redmill.

Last Reading : 293.4 mm at 16-12-14 04:00:53

Default Usage (mm/day): 3

Default Irrigation Date: 23-12-2014

Current Usage (mm/day): -0.4

Current Use Irrigation Date: 16-12-2014

Save Changes

Current

(293.4 mm)

Full Point (mm): 310

Set Full Point to Current

Refill Point (mm): 270

Set Refill Point to Current

Rainfall

0 mm in last hour

0 mm in last 6 hours

0 mm in last 24 hours

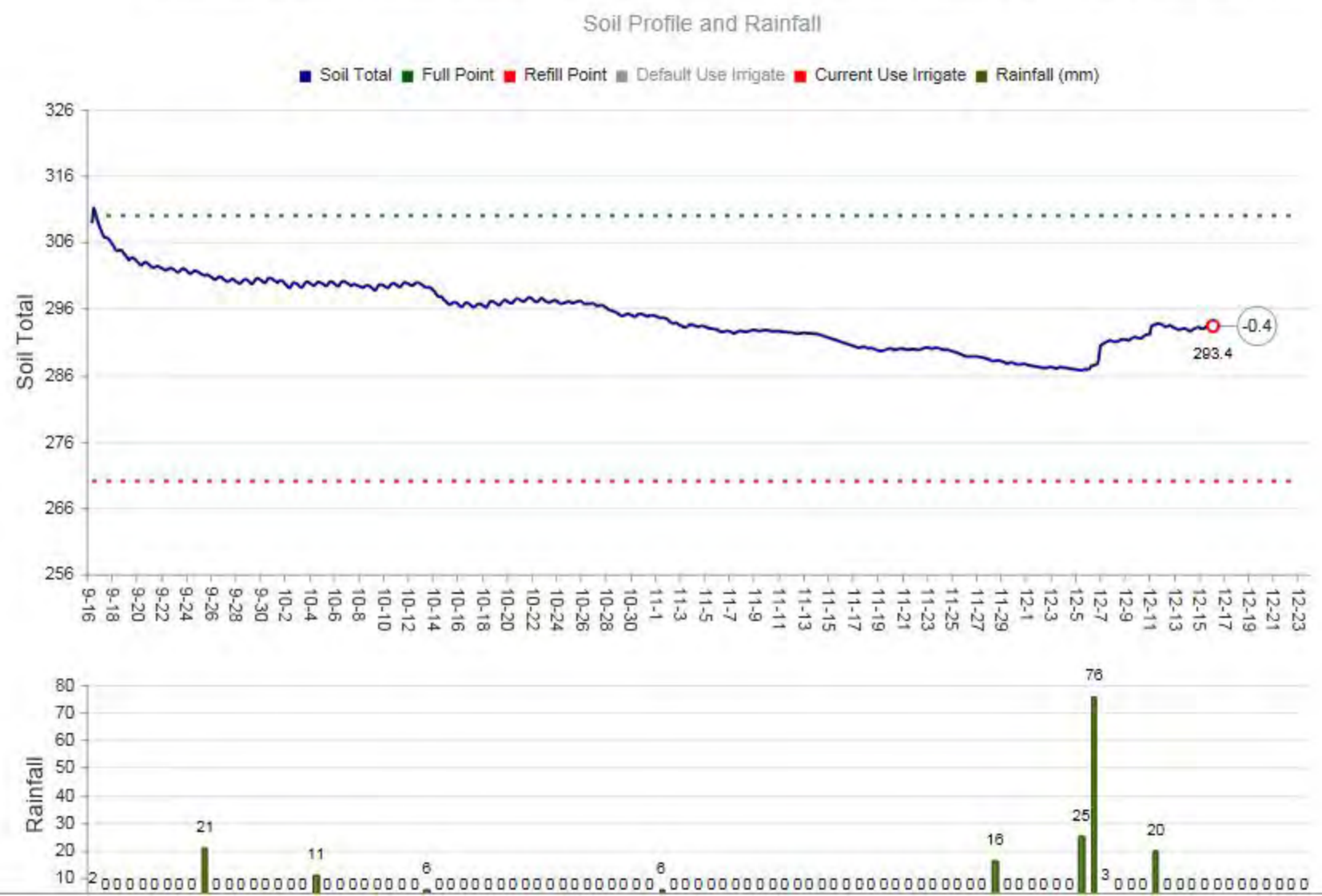
0 mm in last 48 hours

20 mm in last 7 days

140 mm in last 30 days

186 mm in last 365 days

Show Zoom | Show Default Usage Irrigate | Hide Current Usage Irrigate | Show Daily Usage | Show Notes | Historical Reporting



Gwydir Valley
Cotton Grower's Association Inc.

Australian Government
Cotton Research and Development Corporation

CottonInfo Information when you need it

Grower investigation of tools to manage soil compaction in irrigated cotton soils in the Gwydir Valley

Compaction in irrigated cotton soils is believed to be limiting productivity. In compacted soils the reduction in pores restricts root movement, air circulation, water infiltration and drainage. Plant roots do not grow through pores smaller than the root diameter. If the porosity of the soil consists of pores smaller than the roots, roots development will be restricted by insufficient space for growth. The ability of roots to take up water or nutrients is impacted, thus limiting yield potential.

Compaction occurs directly under and around the contact area. Tyre width has minimal effect on compaction deeper in the soil profile. Near-surface compaction is reduced as tyres become wider. The degree of compaction depends on the force compressing the soil, the contact area, the strength in the soil and the type of soil. Heavy vehicles compact the soil more deeply.

Compaction can be minimised if machinery is not used unless the soil is sufficiently dry down through the soil to a depth of a meter or more.

Given the good water holding capacity of vertisols found in northern NSW it can be difficult to dry the soil to depth prior to picking or pupae busting.

Cracking clay soils across the Gwydir Valley do repair themselves when they are able to have a series of four or five wet and dry cycles. The challenge is fitting this into a profitable rotation program.

The Gwydir Valley project initiated in 2014 investigated possible crop rotations and mechanical approaches which may help reduce the degree of compaction in irrigated soil.

The five approaches investigated were;

- Mechanical deep ripping.
- Dryland wheat
- Irrigated wheat
- Vetch
- Safflower.

The rotation crops were planted in June 2014 and the deep ripping took place at the same time.

Methodology

Each of the treatments was compared using a set of simple observations as outlined in the Northern Rivers Soil Health Card. The tests included in the Red Mill trial were; percentage of ground cover, penetrometer depth measure, infiltration, root development, soil structure assessment, aggregate stability test at 10cm and 20cm, and a soil pH test at 5 and 20cm.

Additional measures included a soil cone resistance test on the 26th of March and seasonal C-probe measures for each treatment.

The White Paint Infiltration Test was conducted leading up to the March field day, to aid in highlighting soil pores.

Ground Cover: In march all treatments had less than 50 percent ground cover of mulch or plants.

Penetrometer: The penetromerter readings were between 12 and 17 for each treatment.

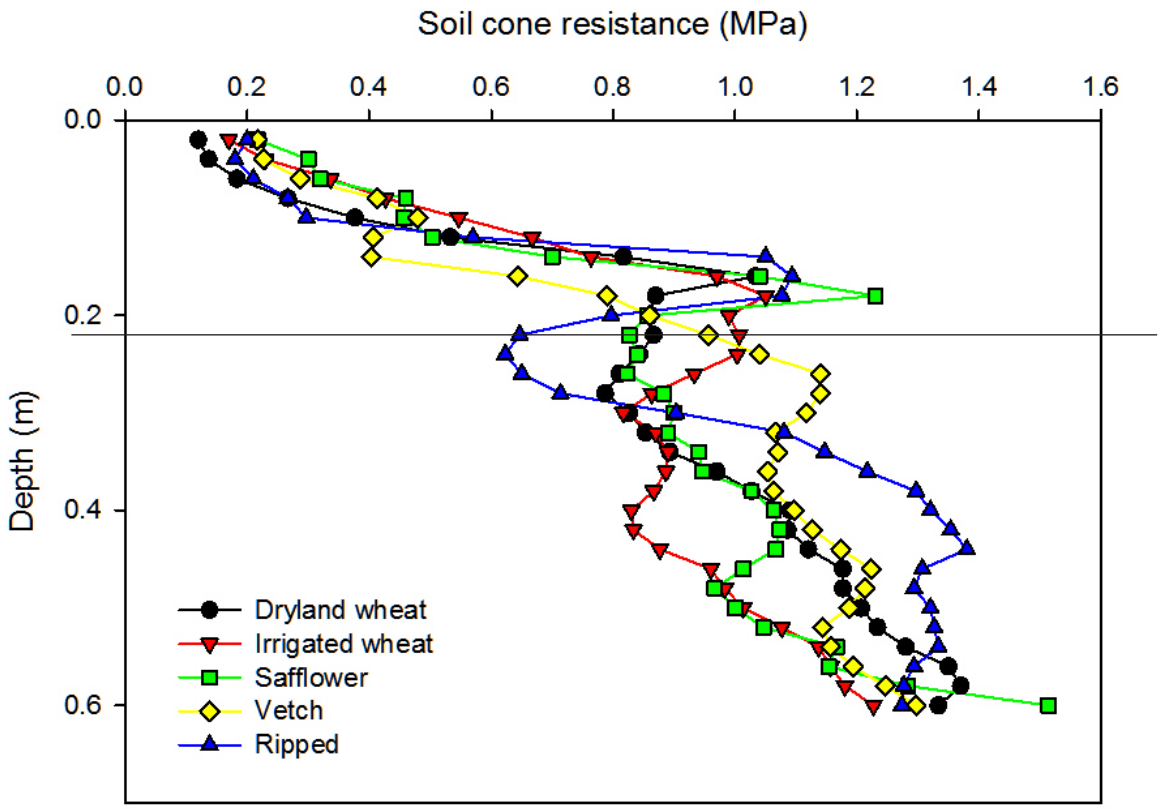
Infiltration: Test results indicated that infiltration rates were poor for all treatments.

Aggregate Stability: All measures for both depths were between 1 and 3, meaning aggregates broke apart in less than a minute. An indication of poor stability.

Soil pH: pH measures of 7 were found throughout the trial at both 5 and 20cm.

Soil Pit Observations 26th March 2015

Parameter	Ripped	Vetch	Safflower	Irrigated wheat	Dryland wheat
Soil surface	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.	Cracked crust well aggregated below to 10 cm.
Structure	Blocky & lenticular structure at depth indicates compression. Slickensides mid-pit indicates some wet/dry.	Blocky structure at depth indicates compaction. Aggregates lack porosity. Slickensides mid-pit indicates some wet/dry.	Angular aggregates at depth. Gypsum present mid pit.	Few slickensides. Large angular blocky aggregates at depth.	No slickensides, little wet/ dry activity. Platy & blocky aggregates.
Profile moisture	Surface moist, wet at base of pit.	Wet throughout, red mottle at depth, water-logged?	Dry at top & base of pit, moist between.	Moist though depth of pit. Not as dry as safflower pit.	Wet surface & mid pit, moist at depth. Drier than ripped/ vetch
Roots	No roots.	Mostly surface.	Roots through depth of pit.	Roots through depth of pit.	Roots surface and mid pit.
Other features	Vertical slot infilled with loose material.			Wheel tracks evident.	Wheel tracks evident.



A recording cone penetrometer was used to measure soil strength under each of the treatments.

Soil strength increases with depth, due to the weight of the soil above. It also increases with a decrease in soil water content. Based on observations from soil pits it was assumed that the soil water content was similar across all treatments.

The Soil Cone Resistance measures above show that under all treatments the soil strength increased to 0.2 m. Below this level treatment differences were observed.

The strength decreased to 0.3, 0.4 m under dryland and irrigated wheat and safflower. While strength decreased to 0.22 and 0.25 m under vetch and the ripped treatment.

Below these depths soil strength again increased to 0.6 m under all treatments. The exception to this pattern was the ripped treatment where soil strength decreased markedly at 0.25-0.3 m, the depth of ripping. The ripping treatment reduced compaction to the depth of ripping, but it is unclear how long this improvement will last.

The trial demonstrated that rotation crops differ in their ability to dry the profile to depth.

- Safflower, irrigated wheat and then dryland wheat were practical rotation crops which may aid in managing soil compaction.
- Safflower dried the profile more than either of the wheat treatments.
- Vetch has little impact on profile drying.

Roots were evident to the base of the pits (1.0 m) under irrigated wheat and safflower, while under dryland wheat roots reached a depth of 0.3-0.4 m and under the vetch they were restricted to the immediate surface soil (0.1 m).

Mechanical ripping loosened the soil to the depth of ripping with little change below this depth.

Ripping could be a valuable tool in the management of compaction, but the reduction in compaction was limited by the depth achieved in the ripping process.

The depth of ripping will be impacted to some degree by the soil moisture at time of ripping. Growers need to assess soil moisture to below the depth of ripping. Ideally soil moisture should be lower than the soils plastic limit; as determined by the rod test. This will ensure maximum depth is achieved.

CottonInfo

Australian Government
Cotton Research and Development Corporation

Gwydir Valley Cotton Growers Association

PO Box 824
Moree, NSW, 2400

Phone: 02 67 521 399
Email: gwydircotton@gwydircotton.com.au