Extracts from the:

Monitoring Mallee Seeps

Project 1498C for the

South Australian Murray-Darling Basin

Natural Resources Management Board

Progress Reports from Jan-Dec 2016

Spading Chicken Manure at Karoonda Trial Sections

by Chris McDonough,

Farming Systems Consultant

Insight Extension for Agriculture

This project is funded through the South Australian Murray-Darling Basin Natural Resources Management Board and the Australian Government's National Landcare Program

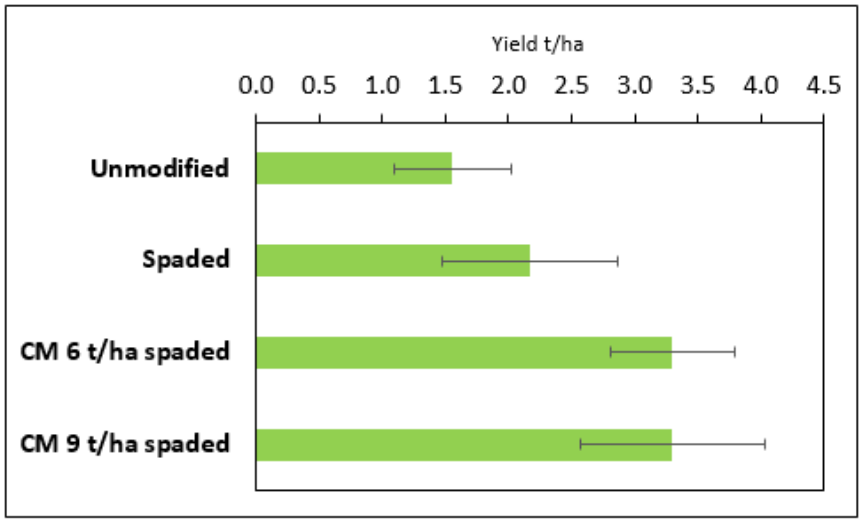
Australian Government | National Landcare Programme

Government of South Australia
South Australian Murray-Darling Basin Natural Resources Management Board

Pope Spading Trial 1st Year Results

Huge improvement in greener, thicker crop, with rooting depth to 1m on Spaded Chicken Manure side, compared to poor growth and shallow roots to only 30cm on Control side.

Yield and Gross Margin results from the 2015 trial showing a 1.75t/ha yield advantage to spaded chicken manure treatments, and 0.62t/ha yield increase for spading only. This emphasises the need for soil amelioration to both break deep soil compaction and increases soil health and fertility.



Modification:	Unmodified	Spaded	CM 6t/ha Spaded	CM 9 t/ha Spaded
Average grain yield (t/ha)	1.55	2.17	3.29	3.30
Income @ $220/t	$ 342	$ 478	$ 725	$ 726
Additional income	**$ -**	**$ 136**	**$ 383**	**$ 384**
Cost of modification	$ -	$ 100*	$ 310*	$ 415*
Increase $ in first year	**$ -**	**$ 36**	**$ 73**	**-$ 31**

*Spading contract cost with larger machine that ridges and better firms the soil is approx. $160/ha, not $100/ha

Pope Spading Trial 2nd Year Results

The 2nd year trial results gives a clear indication that the benefits of spading chicken manure has carried through to second season. It has paid for the cost of the soil amelioration, and has provided gross margins in excess of $400/ha.

Figure 17 shows the 2016 Google earth map of the trial site taken in October while the crop was still ripening. While it shows there are some inherent natural soil differences across the main site, it clearly shows a darker green crop where the chicken manure was spaded in 2015, which is also very clear on the northern trial site area, where the 12t/ha spaded chicken manure area is outstanding. Unfortunately this northern trial is too steep and sandy for the plot harvester traverse and gather yield data.

There is also evidence of where the farmer spread his left over urea for the paddock which included a small corner of the original trial. This has been accounted for in the trial analysis. While this is a farmer scale trial covering 3.7ha, the plots were harvested using the SARDI plot harvester and samples taken for yield and quality analysis. Each treatment was divided into 3 sections to help make more direct comparisons between the similar sand zones, as shown in Fig 17. Section 2 generally was the worst sand, followed by Section 1, while Section 3 is inherently slightly more productive sand. 2 reaping passes were made through each treatment, meaning a total of 6 plot samples were taken from each treatment. The complete results data is shown in Table 3, with treatment averages shown in Table 2.

Fig 17. Trial site map around main seep area (Google Earth Oct 2016)

Table 2 shows a summary averaging all treatment plots, and clearly indicates that the spaded chicken manure treatments have continued to significant yield advantages over the control areas of 1.9t/ha for the 9t/ha spaded chicken manure, and 1.4t/ha for the 6t/ha spaded chicken manure. The 2 year gross margin which takes into account the high initial cost of these soil amelioration treatment, show that the benefits have already outweighed the costs by over $400/ha where chicken manure was spaded, while the ongoing value of spading only has been diminished.

Table 2. 2016 Trial Treatment Results averaging all plot sections.

Treatment	Ave Treatment Yield (t/ha)	Ave Treatment Protein (%)	Ave Yield above Control (t/ha)	Ave N Export in Grain (kg/ha)	Ave Treat. 2 Year GM over Control ($/ha)
Control West	2.3	8.2		85	
Spaded Only	2.2	7.9	-0.14	77	$41
Sp Chicken Man 9t/ha	4.2	8.9	1.87	169	$416
Sp Chicken Man 6t/ha	3.7	8.7	1.44	148	$425
Control East	2.3	7.8		81	

The Spaded Only area yielded poorer than the control and exported less N. This is because the higher yields from Spaded Only in 2015 exported more N, leaving 27kg/ha less N in the soil profile according to deep soil test taken in June 2016 (see Table 5). This clearly shows the importance of supplying extra nutrition with the spading, if longer term yield benefits are to be experienced. While spading can loosen compacted sand and allow roots to access deep soil moisture, these sands are still naturally extremely infertile and cannot reach yield potential without significantly higher nutrition.

These soil test results also show that the N levels from the spaded chicken manure areas were similar to the control areas in June 2016 after exporting significantly higher N in the 2015 yields. The fact that the higher yields and proteins in 2016 led to 84kg/ha more N exported from the 9t/ha Chicken Manure Spaded area than the control area, and 63kg/ha from the 6t/ha Chicken Manure Spaded area, show that the chicken manure is continuing to contribute significant amounts of N into soil throughout the growing season.

Table 2. Complete plot harvest details by treatments and plot sections, including grain quality

Treatment	Section Area	Rep	1. Yield (t/ha)	2. Protein (%)	3. Screenings (%)	4. N exported in grain (kg/ha)	5. Diff in N export over control (kg/ha) ave.	6. Ave yield (t/ha)	7. Ave Protein (%)	8. Yld Above Control (t/ha)	9. % Yld Increase
Control West	1	a	2.59	8.3	1%	98	Ave N export				
Control West	1	b	1.73	8.2	1.8%	64	86	2.16	8.3		
Control West	2	a	2.54	8	1.3%	92					
Control West	2	b	1.67	7.8	2.5%	59		2.10	7.9		
Control West	3	a	2.59	8.3	1.5%	98	Soil Test N				
Control West	3	b	2.64	8.6	1.4%	103	60kg/ha	2.61	8.5		
Spaded Only	1	a	1.80	8.2	1.6%	67	Ave N export				
Spaded Only	1	b	1.75	7.6	1.5%	60	79	1.77	7.9	-0.38	-18%
Spaded Only	2	a	1.43	7.3	2.1%	47	- Control				
Spaded Only	2	b	1.65	6.9	2.1%	52	-6	1.54	7.1	-0.56	-27%
Spaded Only	3	a	3.13	8.4	1.5%	119	Soil Test N				
Spaded Only	3	b	3.17	9	1.4%	130	33kg/ha	3.15	8.7	0.53	20%
Sp Chicken Man 9t/ha	1	a	4.23	8.4	1.7%	162	Ave N export				
Sp Chicken Man 9t/ha	1	b	3.37	8.6	1.5%	132	174	3.80	8.5	1.64	76%
Sp Chicken Man 9t/ha	2	a	4.97	8.1	0.9%	183	- Control				
Sp Chicken Man 9t/ha	2	b	3.18	9.8	1.4%	142	89	4.07	9.0	1.97	94%
Sp Chicken Man 9t/ha	3	a	4.38	9.2	1.2%	183	Soil Test N				
Sp Chicken Man 9t/ha	3	b	4.87	9.3	1.0%	206	58kg/ha	4.62	9.3	2.01	77%
Sp Chicken Man 6t/ha	1	a	3.84	8.3	1.4%	145	Ave N export				
Sp Chicken Man 6t/ha	1	b	4.31	9.6	1.7%	188	149	4.07	9.0	1.92	89%
Sp Chicken Man 6t/ha	2	a	3.07	8.2	1.5%	114	- Control				
Sp Chicken Man 6t/ha	2	b	3.07	8.3	1.4%	116	64	3.07	8.3	0.96	46%
Sp Chicken Man 6t/ha	3	a	4.41	9.2	1.6%	184	Soil Test N				
Sp Chicken Man 6t/ha	3	b	3.70	8.8	1.4%	148	69kg/ha	4.06	9.0	1.44	55%
Control East +N*	1	a	2.79	9.7	3.9%	123					
Control East +N*	1	b	2.69	10.1	4.0%	123		2.74	9.9		
Control East	2	a	1.92	7.6	1.4%	66	Ave N export				
Control East	2	b	1.99	7.2	2.2%	65	82	1.95	7.4		
Control East	3	a	2.54	8.7	1.6%	100	Soil Test N				
Control East	3	b	2.72	7.8	2.5%	96	60kg/ha	2.63	8.3		

*Farmer spread leftover urea at very high rate (100-150kg/ha) on this area, so has not been included in treatment averages

Table 3 shows the harvest results of all the trial plots. Column 2 shows that all plots had protein levels below what is required to achieve APW quality. While the nitrogen supplied by the 6 and 9t/ha of chicken manure treatment areas has generally resulted in higher protein levels, the yields of these plots averaging between 1.4-1.9 higher than control was where the majority of extra available N was utilized. This is clearly evidenced in column 4 highlighting the N export in the grain based on yield and protein, where the 9t/ha chicken manure spaded plots found and exported 89kg/ha N more than the control, while the 6t/ha chicken manure spaded area exported 64kg/ha more N.

Columns 6-9 of Table 3 are colour coded so that direct comparisons can be made between the different sand zones within the trial area. Table 4 provides a comparative gross margin assessment of the cost of the various treatments over the control plots.

Because all the extra cost occurs in the first year, the 2 year gross margin of the 9t/ha treatment is now very similar to the 6t/ha treatment (as the higher cost of the 9t/ha site was still slightly negative after year 1). The higher rate has resulted in the highest yield in 2016 and a 2 year gross margin of $416/ha, with the 6t/ha plot (although yielding slightly lower) showing a 2 year gross margin above the control area of $425/ha.

An average grain price of $220/t was used in gross margin calculations for both years. While this is slightly higher than the present grain prices, it does reflect a more average grain price for the region. It is interesting to note that the spading chicken manure treatments have consistently shown the highest gross margin advantage over the control in section 2, the poorest sand area, as can be seen in Tables 2 and 4.

Table 4. Gross Margin analysis for treatment costs above control areas.

Treatment	Original Treatment cost $/ha	YR 1 (2015) GM over control @ $220/t	YR 2 (2016) GM over control @ $220/t	2 Year GM over control ($/ha)	Ave Treat. 2 Year GM over control ($/ha)
Spaded Only	$100	$31	-$84	-$53	$41
Spaded Only	$100	$21	-$124	-$104	
Spaded Only	$100	$162	$118	$280	
Sp Chicken Man 9t/ha	$415	-$125	$361	$236	$416
Sp Chicken Man 9t/ha	$415	$164	$434	$598	
Sp Chicken Man 9t/ha	$415	-$28	$442	$415	
Sp Chicken Man 6t/ha	$310	$3	$421	$424	$425
Sp Chicken Man 6t/ha	$310	$265	$212	$477	
Sp Chicken Man 6t/ha	$310	$55	$318	$373	

Table 5. 2nd year soil testing at spading site for changes & carry over nutrition, June 2016

Apal	Mg	Na	Nitrate NO3	Ammonium	Avail N	Colwell K	Organic Carbon	Colwell P	PBI	CL Sulf	Exch K	Exch Ca	Exch Mg	Exch Na	ECEC	Exch K	Exch Ca	Exch Mg	Exch Na	Ca:Mg
	mg/kg	mg/kg	mg/kg	mg/kg	kg/ha	mg/kg	%	mg/kg		mg/kg	c.mol/kg	c.mol/kg	c.mol/kg	c.mol/kg	c.mol/kg	%	%	%	%	ratio
POPE CONTROL 0-10	43.9	8	7.5	8	26	72	0.48	30	13.3	5.2	0.144	1.372	0.361	0.035	1.93	7.47	71.00	18.70	1.80	3.80
POPE CONTROL 10-40	38.1	24.2	2.2	3.7	30	48	0.11	17	12.8	4.3	0.103	1.747	0.314	0.105	2.27	4.52	77.01	13.83	4.64	5.57
POPE CONTROL 40-60			0.5	0.5	3															
				Total	60															
POPE 6TCM 0-10	39.3	8	5.5	5	18	81	0.31	25	10.8	9.2	0.166	1.072	0.323	0.035	1.61	10.32	66.76	20.14	2.17	3.32
POPE 6TCM 10-40	30.4	8	2	5.3	37	72	0.11	15	11.5	3	0.174	1.022	0.250	0.035	1.49	11.65	68.57	16.78	2.33	4.09
POPE 6TCM 40-60			0.5	0.5	3															
				Total	58															
POPE 9TCM 0-10			17.1	4.9	37															
POPE 9TCM 10-40			3.8	0.5	22															
POPE 9TCM 40-60			1.6	1.1	9															
				Total	69															
POPE SPADED 0-10			3.8	2.3	10															
POPE SPADED 10-40			3.3	0.5	19															
POPE SPADED 40-60			0.5	0.5	3															
				Total	33															