



LUCERNE
AUSTRALIA

**EVALUATING
DIFFERENT FERTILISERS
IN LUCERNE SEED PRODUCTION
FIRST YEAR RESULTS 2012-2013**



Australian Government
**Rural Industries Research and
Development Corporation**



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Introduction

Lucerne Australia has received Rural Industries Research and Development Corporation (RIRDC) funding to undertake an independent fertiliser trial on both dryland and irrigated lucerne seed systems in the South East South Australia. It commenced in 2012 and the duration of the project is a minimum three years, potentially five years. It will provide a clear picture of determining what fertiliser products will deliver the maximum benefits for lucerne seed producers with the primary focus on seed yield. The extensive variety of fertiliser products, range from traditional granular products to liquid to a variety of compost mixes. The products are triple replicated on both an irrigated site and dryland site, totalling 180 plots.

The expected outcome of this project is for the lucerne seed industry to benefit by being able to cost effectively fertilise lucerne for seed crops, thereby finding the optimum investment level of fertiliser applications required to maximise seed yields and gross margins.

Project Objectives

- Determine which fertiliser treatment will deliver total maximum seed yield.
- Evaluate which treatment will deliver the most economic seed yield in terms of yield output for dollar input.
- Evaluate if there is a relationship between foliage and seed yield.
- Measure soil fertility using soil and sap tests.
- Determine the accumulated effects of the four above objectives in a long term production phase.
- Observe any side effects associated with the different types of fertilisers on lucerne seed production – this will be observation only and may assist with identifying possible problems with different treatments for the future.
- Deliver objective, accurate and timely results to industry in an accessible format.

First Year Results

This project has a comprehensive project plan and in its first year, soil tests, sap tests, fertiliser rates and fertiliser applications, foliage and harvesting were all completed. All actions were undertaken in a timely manner, with extensive soil tests matching predictions and expectations on soil fertility and achieving consistency across both the irrigated and dryland sites.

Fertiliser products were applied at the optimum time in autumn and spring and applications were in accordance to the rates per hectare recommended and in conjunction with common district practices.

The completion of the first year of this trial was above expectation. This included timing of fertiliser applications, soil tests, sap tests, observations and harvest production. Yield showed limited statistical differences in this first year. However, yield results across the irrigation site showed exceptional levels of CV (coefficient of variance), confirming the suitability of the trial site chosen.

The limited level of statistical difference between products in the first year is associated with fertiliser products breaking down over longer periods of time, soil nutrient levels building and lucerne plants being able to access the nutrients available. Greater statistical differences are predicted in years two and three, acknowledging that the longer the trial, the greater the statistical value of what fertiliser products will achieve greatest seed yield.

Lucerne Australia would like to thank all those involved in this trial including RIRDC, Project Manager 'Peracto SA', landowner Brecon Proprietors and the fertiliser companies for providing products for the trial.

Table 1: Dryland Trial Site Treatment List

Trt No.	Product Supplier	Treatment	Rate	Rate Unit	Application	Product Cost (\$/ha)	
1		Untreated Control				0.00	
2	Impact Fertilisers	Scrub Mix	100	kg/ha	Spring	65.50	
3		MAP S/SOP 2 & 1	150	kg/ha	Spring	97.50	
4		Plain Super	50	kg/ha	Spring	17.25	
5		Plain Super	100	kg/ha	Spring	34.50	
6		Plain Super	150	kg/ha	Spring	51.75	
7		Super Potash 2 & 1	50	kg/ha	Spring	22.45	
8		Super Potash 2 & 1	100	kg/ha	Spring	44.90	
9		Super Potash 2 & 1	150	kg/ha	Spring	67.35	
10		Sulphate of Potash (SOP)	50	kg/ha	Spring	44.50	
11		Muriate of Potash (MOP)	50	kg/ha	Spring	30.75	
12		Lucerne K 36 B 0.95% Zn 0.19%	105	kg/ha	Spring	74.03	
13		Lucerne K 38 B 0.77% Zn 0.15%	130	kg/ha	Spring	89.83	
14		Lucerne K 31 B 1.25% Zn 0.25%	80	kg/ha	Spring	58.16	
15		Home Brew	Lucerne Mix 1 low cost (mix A)	100	l/ha	Autumn	68.00
	Lucerne Mix 1 low cost (mix A)		50	l/ha	Post Hay Cut		
16		Lucerne Mix 2 high cost (mix A++)	100	l/ha	Autumn	105.00	
		Lucerne Mix 2 high cost (mix A++)	50	l/ha	Post Hay Cut		
17	Lawrie Co	BioGraze	125	kg/ha	Spring	41.00	
18		BioGraze 2 in 1	125	kg/ha	Spring	62.00	
19		BioGraze 5 in 1	125	kg/ha	Spring	54.00	
20		SS/SOP/Humate granules	125	kg/ha	Spring	75.00	
21	Gary Ferguson	Pig Manure	2000	kg/ha	Autumn	240.00	
22	Southern Soils Fertiliser	NutriCal	10	l/ha	Autumn	174.00	
		NutirCal	10	l/ha	Spring		
		NutriCal	10	l/ha	Post Hay Cut		
		BioCoat	100	kg/ha	Spring		
23			NutriCal	15	l/ha	Autumn	174.00
			NutriCal	15	l/ha	Post Hay Cut	
			BioCoat	100	kg/ha	Spring	
24			NutriCal	15	l/ha	Autumn	179.00
			NutriCal	15	l/ha	Spring	
			Scrub Mix	100	kg/ha	Spring	
25	Haby's Manure Supplies	Chicken Manure	2000	kg/ha	Autumn	84.00	
26		Compost	1000	kg/ha	Autumn	84.00	
27	Stoller Australia	Foli-Zyme	5	l/ha	Post Hay Cut	85.00	
		Super Potash 2 & 1	100	kg/ha	Spring		
28		Bio-Forge	1.2	l/ha	Post Hay Cut	124.00	
		Super Potash 2 & 1	100	kg/ha	Spring		
29	Agrichem	Booster Zinc Moly	2	l/ha	Autumn	74.00	
		Supa Trace Advance	2	l/ha	Autumn		
		Super Potash 2 & 1	100	kg/ha	Post Hay Cut		
30		Balance 3ZBM	2	l/ha	Post Hay Cut	73.00	
		Foliar Boost	4	l/ha	Post Hay Cut		
		Super Potash 2 & 1	100	kg/ha	Spring		

Note:

- Granular and manure products are applied by broadcast methods (simulated spreader)
- Liquid products are applied using hand boom equipment fitted with Agrotop AI 110-01 nozzles
- Post hay cut treatments were targeted 14 days after hay cut.
- Product cost is calculated using recommended retail prices provided by suppliers. This cost does not

Table 2: Chronology of Dryland Trial Events

Date	Action
20th Dec-11	Soil and SAP analysis
27th April-12	Autumn Fertiliser Applied (application A)
18th Sept-12	Spring Fertiliser Applied (application B)
13th Nov-12	Post Hay Cut Fertiliser Application (application C)
18th Dec-12	Greenseeked and SAP Analysis
18th Feb-13	Trial Harvested

Table 3: Broad acre management activities of dryland trial site

Date	Action	Product Applied	Application Rate
Jun-08	Lucerne Established <i>Variety: FG91TO13</i>		
Sep-11	Fertiliser Applied	Single Super	150 kg/ha
Jul-12	Winter Clean	Broadstrike	25 g/ha
		Buttress	2.4 l/ha
Aug-12	Grass Spray	Elantra Extreme	190 ml/ha
		Quicken Oil	500 ml/ha
Sep-12	Trace Element Spray	MnZinc	4 l/ha
25th Oct-12	Hay Cut		
Dec-12	Trace Element Spray	MnCu	4 l/ha
		Fastac	160 ml/ha
Jan-13	Trace Element Spray	MnCu	4 l/ha
		Fastac	160 ml/ha
1st Feb-13	Desiccant Applied		

The trial site is maintained in season by the land owner. The management program mirrors the management used across the remainder of the surrounding paddock. All treatments in the trial received the management program noted above in table 3.

Site nutrient status prior to the initiation of the trial.

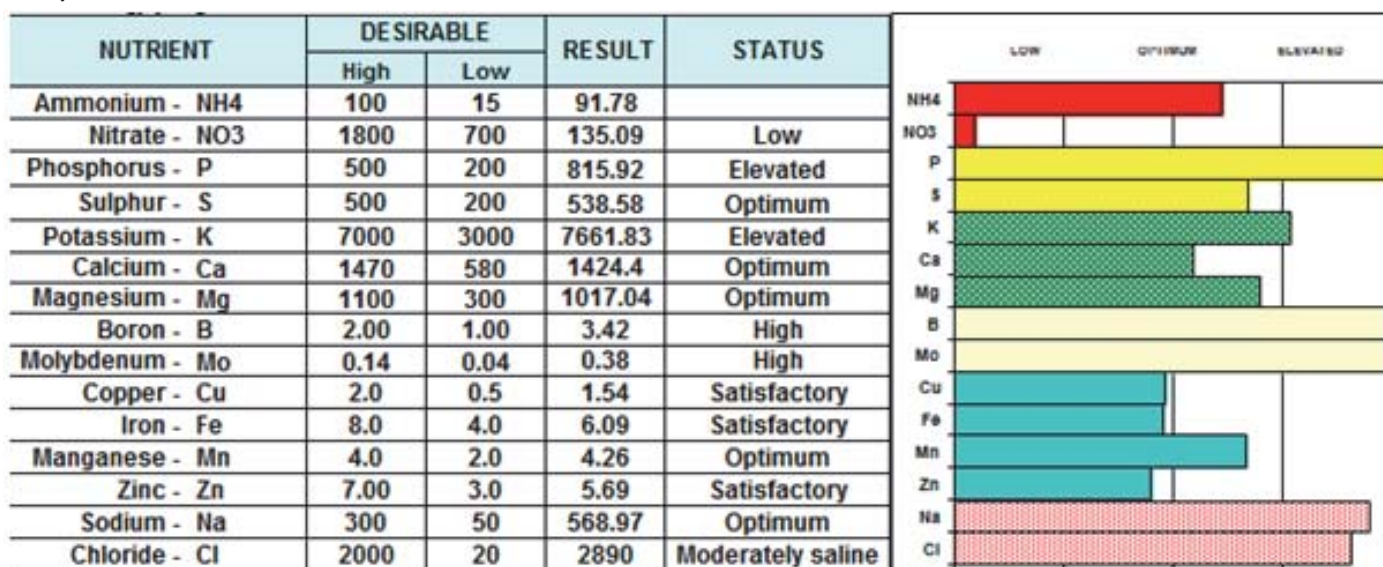
Prior to the initiation of the trial, all plots within the trial under went both soil and SAP analysis. This analysis was to formulate a baseline nutrient status which will allow nutrient shifts to be tracked throughout the life of the trial. While the SAP analysis showed the plants to be growing with optimum to high levels of all nutrients, the soil test showed there is the potential for deficiencies in Phosphorus, Potassium, Magnesium, Copper and Boron (seen in table 4)at the site.

Table 4: Soil nutrient analysis conducted on the Dryland site before the Initiation of the trial, test conducted 20/12/2011

Nutrient	Desirable Level (mg/kg)		Site Result (mg/kg)	Nutrient Status
	High	Low		
Phosphorus - P	90	40	38.3	Low
Potassium - K	320	195	90.3	Very Low
Sulphur - S	45	12	13.5	Satisfactory
Calcium - Ca	2200	1300	900	Low
Magnesium - Mg	330	135	83	Low
Zinc - Zn	8	1.6	4.1	Satisfactory
Iron - Fe	200	30	64	Satisfactory
Manganese - Mn	70	18	5.6	Very Low
Copper - Cu	10	2.5	2.2	Low
Boron - B	4	1.7	1.1	Low
Sodium - Na	63	16	55.1	Satisfactory
Chloride - Cl	<200	0	0	Satisfactory
pH H2O	7	6	6.4	
pH CaCl2	6.5	5.4	5.8	

Note: The desirable level and nutrient status listed in table 4 are based on soil properties and therefore they are not specific for the requirements of Lucerne crops

Figure 1: Lucerne SAP analysis conducted on the Dryland site prior to the initiation of the trial, analysis conducted 20/12/2011



Note: The 'desirable and status' data in figure 1 above is based upon the nutrient requirements of Lucerne plants.

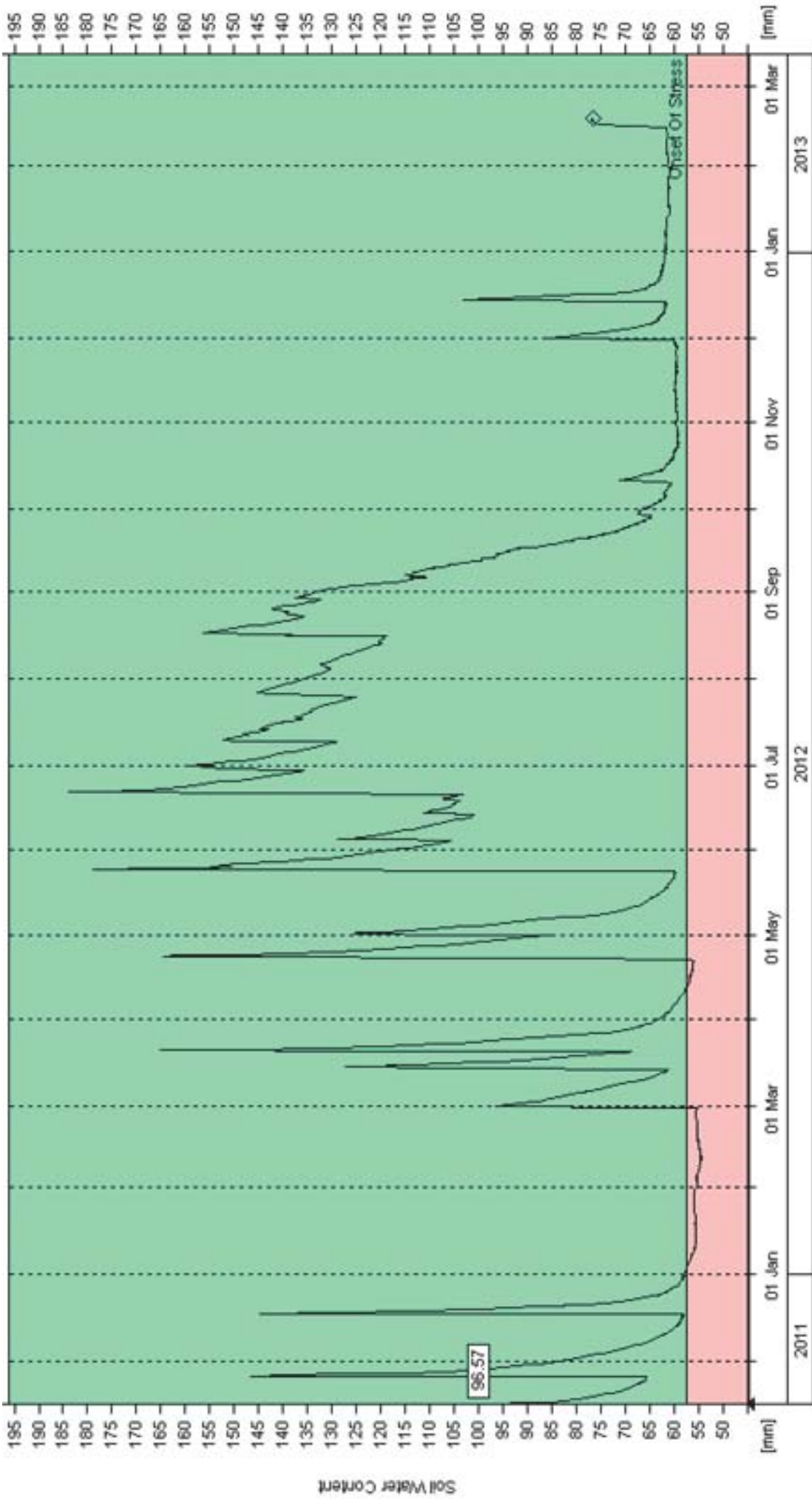


Figure 2: Soil moisture content of the Dryland site for the 2012-13 season. The soil moisture graph is a summary of soil moisture sensors located at depths of 10, 20, 30, 40, 60 and 80cm below the soil surface. The graph gives an insight to the growing season rainfall which was well below average for the later part of 2012. The graph also indicates that there was very minimal rainfall after the spring fertilisers were applied on the 18th of September 2012.

Table 5: Dryland Trial Site Results for 2012-13 Growing Season

Treatment No.	Treatment	NDVI	Clean Seed Yield (kg/ha)	Relative Gross Margin (\$/ha)
1	Untreated Control	0.3217 a	66 a	332
2	Scrub Mix (100kg/ha)	0.3192 a	70 a	281
3	MAP S/SOP 2 & 1 (150kg/ha)	0.3108 a	65 a	223
4	Plain Super (50kg/ha)	0.3202 a	103 a	491
5	Plain Super (100kg/ha)	0.3054 a	89 a	403
6	Plain Super (150kg/ha)	0.3331 a	105 a	469
7	Super Potash 2 & 1 (50kg/ha)	0.2924 a	58 a	262
8	Super Potash 2 & 1 (100kg/ha)	0.3196 a	93 a	413
9	Super Potash 2 & 1 (150kg/ha)	0.3027 a	85 a	351
10	Sulphate of Potash (SOP)	0.2773 a	77 a	333
11	Muriate of Potash (MOP)	0.3013 a	89 a	410
12	Lucerne K 36 B 0.95% Zn 0.19%	0.3453 a	101 a	424
13	Lucerne K 38 B 0.77% Zn 0.15%	0.3313 a	100 a	404
14	Lucerne K 31 B 1.25% Zn 0.25%	0.3382 a	112 a	495
15	Lucerne Mix 1 low cost (mix A)	0.3215 a	107 a	445
16	Lucerne Mix 2 high cost (mix A++)	0.3138 a	93 a	338
17	BioGraze	0.3109 a	67 a	287
18	BioGraze 2 in 1	0.3082 a	75 a	308
19	BioGraze 5 in 1	0.3222 a	75 a	313
20	SS/SOP/Humate granules	0.3242 a	81 a	327
21	Pig Manure	0.2980 a	74 a	109
22	NutriCal X3 + BioCoat	0.3019 a	72 a	148
23	NutriCal X2 + BioCoat	0.3030 a	93 a	262
24	NutriCal X2 + Scrub Mix	0.2801 a	54 a	52
25	Chicken Manure	0.3076 a	84 a	316
26	Compost	0.3173 a	72 a	254
27	Foli-Zyme	0.2843 a	57 a	183
28	Bio-Forge	0.3234 a	81 a	264
29	Booster Zinc Moly + Supa Trace Advance	0.2933 a	61 a	216
30	Balance 3ZBM + Foliar Boost	0.3207 a	81 a	317
	LSD (P=.05)	0.0500	44.4	
	Standard Deviation	0.0310	27.2	
	CV	9.84	33.5	

Note:

- Letters accompanying data within table 5 are ' letters of significance'. Although data may appear numerically different, all treatments with the same letter of significance cannot be considered significantly different.
- Seed yield has been measured and displayed on the basis of 99.9% purity of cleaned seed.
- Relative Gross Margin is calculated based on a cleaned seed price of \$5-00/kg. Plus an application cost of \$5-00/ha for granular, \$11-00/ha for liquids and \$20/ha for composts, but excludes freight. No other cost associated with producing the seed are factored in as these are considered constant across all treatments within the trial
- Low soil moisture during the later part of the season indicated in figure 2, lead to high variation in crop growth/yield across the site which resulted in a much higher than desired CV for clean seed yield.

Clean Seed Yield vs NDVI, Dryland Site 2012-13 Growing Season

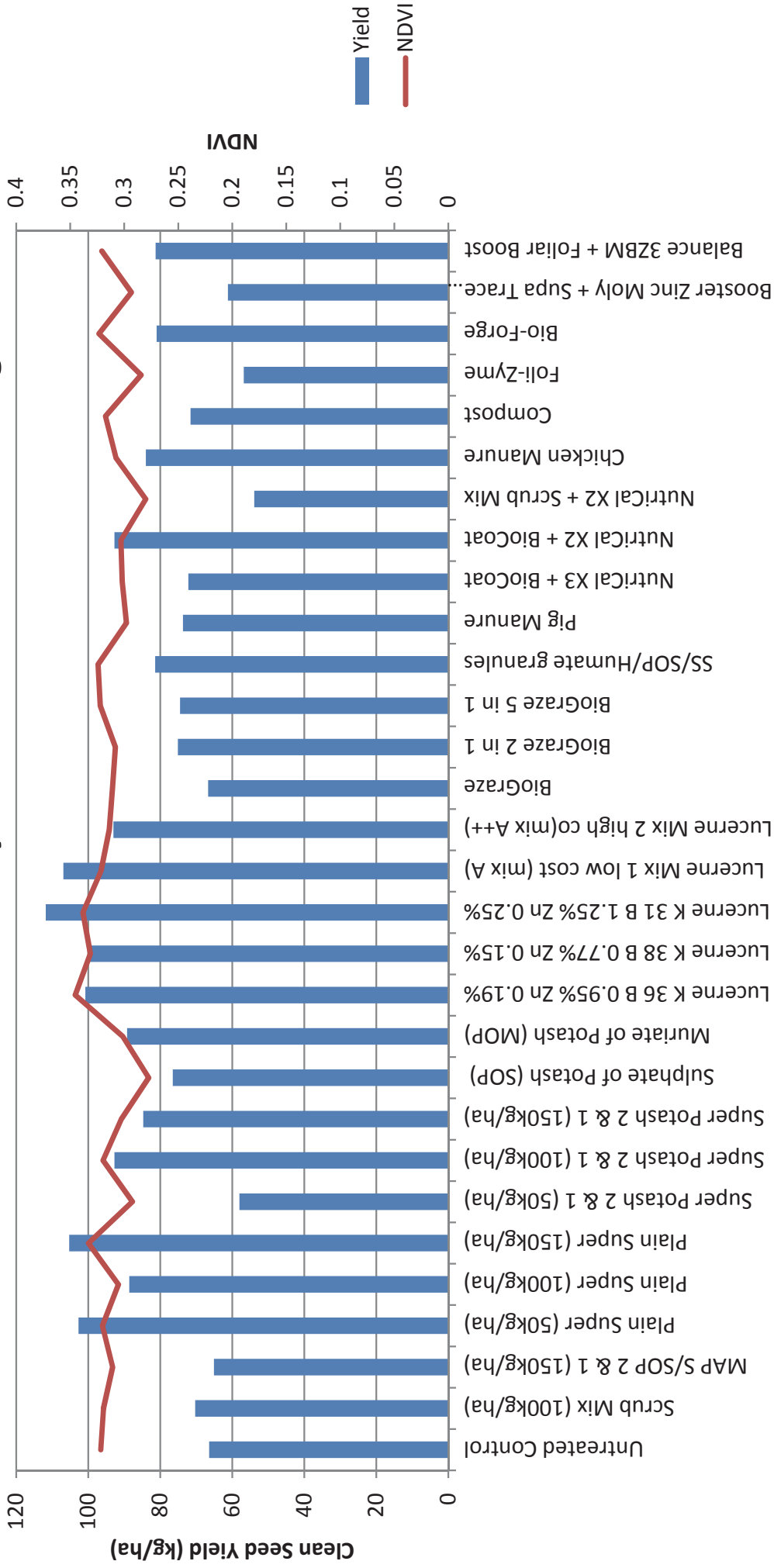


Figure 3: Clean seed yield vs NDVI for the Dryland Site 2012-13 growing season. NDVI (Normalised Difference Vegetative Index) is an indicative measure of crop biomass. The blue bar graph above or below the red lines does not mean better or worse, just the relationship with plant growth and seed yields recorded.

Table 6: SAP Analysis Results, Dryland Site 2012-13 Growing Season.

Treatment No.	Treatment	NO3 (ppm)	P (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	Zn (ppm)	B (ppm)	S (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)	Mo (ppm)	Na (ppm)	Cl (ppm)
Optimum Range for Lucerne	Low level	700	200	3000	580	300	3.00	1.00	200	0.50	4.00	2.00	0.040	50	20
	High Level	1800	500	7000	1470	1100	7.00	2.00	500	2.00	8.00	4.00	0.140	300	2000
1	Untreated Control	166	413	7345	1039	772	3.46	2.03	385	2.20	4.84	18.02	0.840	596	3190
2	Scrub Mix	166	462	7154	974	779	4.68	1.94	373	1.88	4.03	14.19	0.847	428	3213
3	MAP S/SOP 2 & 1	204	479	6640	934	741	3.32	1.88	363	1.84	4.35	13.63	0.869	574	3290
4	Plain Super	139	465	6298	944	808	3.21	1.85	356	2.00	4.64	14.38	0.988	780	3293
5	Plain Super	238	506	7201	992	767	3.49	2.06	399	1.92	4.47	14.76	0.829	433	3538
6	Plain Super	228	455	6960	1034	840	3.85	1.88	381	1.89	4.20	14.71	0.900	550	3190
7	Super Potash 2 & 1	191	446	6761	871	617	4.15	1.71	352	1.76	4.41	13.44	0.816	492	3110
8	Super Potash 2 & 1	276	497	6670	921	726	3.69	1.96	375	1.99	4.32	15.33	0.829	544	3210
9	Super Potash 2 & 1	161	474	6793	828	767	3.06	1.57	352	2.08	4.17	16.52	0.984	550	3437
10	Sulphate of Potash (SOP)	180	490	6623	910	784	4.48	2.02	373	2.14	4.52	16.01	0.992	577	3383
11	Muriate of Potash (MOP)	248	466	6691	1125	745	3.94	2.05	361	2.09	4.10	16.63	0.700	387	3268
12	Lucerne K 36 B 0.95% Zn 0.19%	192	506	7109	980	733	3.57	1.99	393	1.97	4.46	14.72	0.874	507	3440
13	Lucerne K 38 B 0.77% Zn 0.15%	137	499	6617	987	708	3.74	1.65	354	1.78	4.83	13.61	1.063	688	3183
14	Lucerne K 31 B 1.25% Zn 0.25%	161	542	6688	923	863	4.31	1.74	380	2.21	4.37	17.72	1.215	696	3520
15	Lucerne Mix 1 low cost (mix A)	150	503	6909	975	741	3.55	1.48	366	2.02	4.39	14.89	1.100	472	3323
16	Lucerne Mix 2 high cost (mix A++)	160	456	6554	913	709	3.68	1.43	342	1.73	4.19	13.30	0.980	483	3100
17	BioGraze	170	494	7010	866	735	3.73	1.81	361	2.30	4.31	16.63	0.919	602	3072
18	BioGraze 2 in 1	172	494	6919	1008	869	4.52	2.01	414	2.09	4.33	15.52	0.877	650	3410
19	BioGraze 5 in 1	218	502	7480	1000	717	4.28	1.60	407	2.09	5.20	15.89	0.879	477	3167
20	SS/SOP/Humate granules	195	492	6755	886	758	3.70	1.71	396	2.30	4.20	18.48	0.860	650	3352
21	Pig Manure	355	471	7110	917	698	4.23	1.86	401	2.34	4.36	18.26	0.805	449	3342
22	NutriCal X3 + BioCoat	205	513	6875	1024	781	4.43	1.70	380	2.22	4.69	16.75	0.948	660	3440
23	NutriCal X2 + BioCoat	166	514	7004	1012	864	3.55	1.41	398	2.06	5.03	15.92	1.100	680	3398
24	NutriCal X2 + Scrub Mix	112	510	6774	944	776	3.83	1.83	405	2.02	4.67	15.95	1.055	616	3463
25	Chicken Manure	207	475	7050	971	764	3.95	1.60	392	1.95	4.65	14.00	0.880	451	3157
26	Compost	289	490	6994	1057	750	4.18	1.82	413	2.52	5.20	19.81	0.857	585	2880
27	Foli-Zyme	155	489	6748	901	757	4.15	1.54	358	2.22	4.63	15.28	0.937	476	3077
28	Bio-Forge	166	536	6954	900	741	3.47	2.01	429	2.41	4.31	17.94	0.917	543	3052
29	Booster Zinc Moly + Supa Trace Advance	230	458	6740	1078	711	3.94	1.83	376	2.12	4.06	15.66	0.942	505	3297
30	Balance 3ZBM + Foliar Boost	227	488	7061	1301	767	4.20	1.96	420	2.10	5.34	16.48	0.850	501	3092
	LSD (P=.05)	127	99	705	239	144	1.17	0.63	63	0.51	0.82	4.72	0.270	215	491
	Standard Deviation	78	61	432	146	88	0.72	0.39	39	0.31	0.50	2.89	0.165	131	301
	CV	40	13	6	15	12	18.54	21.43	10	15.02	11.10	18.28	17.930	24	9

Table 7: Irrigated Trial Site Treatment List

Trt No.	Product Supplier	Treatment	Rate	Rate Unit	Application	Product Cost (\$/ha)	
1		Untreated Control				0.00	
2	Impact Fertilisers	Scrub Mix	200	kg/ha	Spring	131.00	
3		MAP S/SOP 2 & 1	200	kg/ha	Spring	130.00	
4		Plain Super	100	kg/ha	Spring	34.50	
5		Plain Super	200	kg/ha	Spring	69.00	
6		Plain Super	300	kg/ha	Spring	103.50	
7		Super Potash 2 & 1	100	kg/ha	Spring	44.90	
8		Super Potash 2 & 1	200	kg/ha	Spring	89.80	
9		Super Potash 2 & 1	300	kg/ha	Spring	134.70	
10		Sulphate of Potash (SOP)	100	kg/ha	Spring	89.00	
11		Muriate of Potash (MOP)	100	kg/ha	Spring	61.50	
12		Lucerne K 36 B 0.95% Zn 0.19%	105	kg/ha	Spring	74.03	
13		Lucerne K 38 B 0.77% Zn 0.15%	130	kg/ha	Spring	89.83	
14		Lucerne K 31 B 1.25% Zn 0.25%	80	kg/ha	Spring	58.16	
15		Home Brew	Lucerne Mix 1 low cost (mix A)	100	l/ha	Autumn	68.00
	Lucerne Mix 1 low cost (mix A)		50	l/ha	Post Hay Cut		
16		Lucerne Mix 2 high cost (mix A++)	100	l/ha	Autumn	105.00	
		Lucerne Mix 2 high cost (mix A++)	50	l/ha	Post Hay Cut		
17	Lawrie Co	BioGraze	250	kg/ha	Spring	82.50	
18		BioGraze 2 in 1	250	kg/ha	Spring	123.25	
19		BioGraze 5 in 1	250	kg/ha	Spring	108.00	
20		SS/SOP/Humate granules	250	kg/ha	Spring	150.00	
21	Gary Ferguson	Pig Manure	2000	kg/ha	Autumn	240.00	
22	Southern Soils Fertiliser	NutriCal	10	l/ha	Autumn	235.00	
		NutirCal	10	l/ha	Spring		
		NutriCal	10	l/ha	Post Hay Cut		
		BioCoat	200	kg/ha	Spring		
23			NutriCal	15	l/ha	Autumn	235.00
			NutriCal	15	l/ha	Post Hay Cut	
		BioCoat	200	kg/ha	Spring		
24		NutriCal	15	l/ha	Autumn	245.00	
		NutriCal	15	l/ha	Spring		
		Scrub Mix	200	kg/ha	Spring		
25	Haby's Manure Supplies	Chicken Manure	2000	kg/ha	Autumn	84.00	
26		Compost	1000	kg/ha	Autumn	84.00	
27	Stoller Australia	Foli-Zyme	5	l/ha	Post Hay Cut	129.80	
		Super Potash 2 & 1	200	kg/ha	Spring		
28			Bio-Forge	1.2	l/ha	Post Hay Cut	169.00
		Super Potash 2 & 1	200	kg/ha	Spring		
29	Agrichem	Booster Zinc Moly	2.5	l/ha	Autumn	119.00	
		Maxi Mang	0.3	l/ha	Autumn		
		Super Potash 2 & 1	200	kg/ha	Post Hay Cut		
30			Balance 3ZBM	2.5	l/ha	Post Hay Cut	137.05
		Maxi Fruit	5	l/ha	Post Hay Cut		
		Super Potash 2 & 1	100	kg/ha	Spring		

Note:

- Granular and manure products are applied by broadcast methods (simulated spreader)
- Liquid products are applied using hand boom equipment fitted with Agrotop AI 110-01 nozzles
- Post hay cut treatments were targeted 14 days after hay cut.
- Product cost is calculated using recommended retail prices provided by suppliers. This cost does not include freight or application cost.

Table 8: Chronology of Irrigated Trial Events

Date	Action
20th Dec-11	Soil and SAP analysis
27th April-12	Autumn Fertiliser Applied (application A)
18th Sept-12	Spring Fertiliser Applied (application B)
18th Dec-12	Post Hay Cut Fertiliser Application (application C)
14th Jan-12	Greenseeked and SAP Analysis
19th Feb-13	Trial Harvested

Table 9: Broad acre management activities of irrigated trial site

Date	Action	Product Applied	Application Rate
Jun-11	Lucerne Established <i>Variety: Alphamaster 9</i>		
Sep-11	Fertiliser Applied	Single Super	200 kg/ha
Jul-12	Winter Clean	Broadstrike	25 g/ha
		Buttress	2.4 l/ha
Aug-12	Grass Spray	Elantra Extreme	190 ml/ha
		Quicken Oil	500 ml/ha
Sep-12	Trace Element Spray	MnZinc	4 l/ha
18th Oct-12	Dry Hay Cut		
2nd Nov-12	Irrigation		
	Trace Element Spray	MnZinc	4 l/ha
1st Dec-12	Hay Cut		
21st Dec-12	Irrigation		
Jan-13	Trace Element Spray	MnCu	4 l/ha
		Fastac	160 ml/ha
8th Jan-13	Irrigation		
Feb-13	Trace Element Spray	MnCu	4 l/ha
		Fastac	160 ml/ha
4th Feb-13	Irrigation		

The trial site is maintained in season by the land owner. The management program mirrors the management used across the remainder of the paddock. All treatments in the trial received the management program noted above in table 9.

Site nutrient status prior to the initiation of the trial.

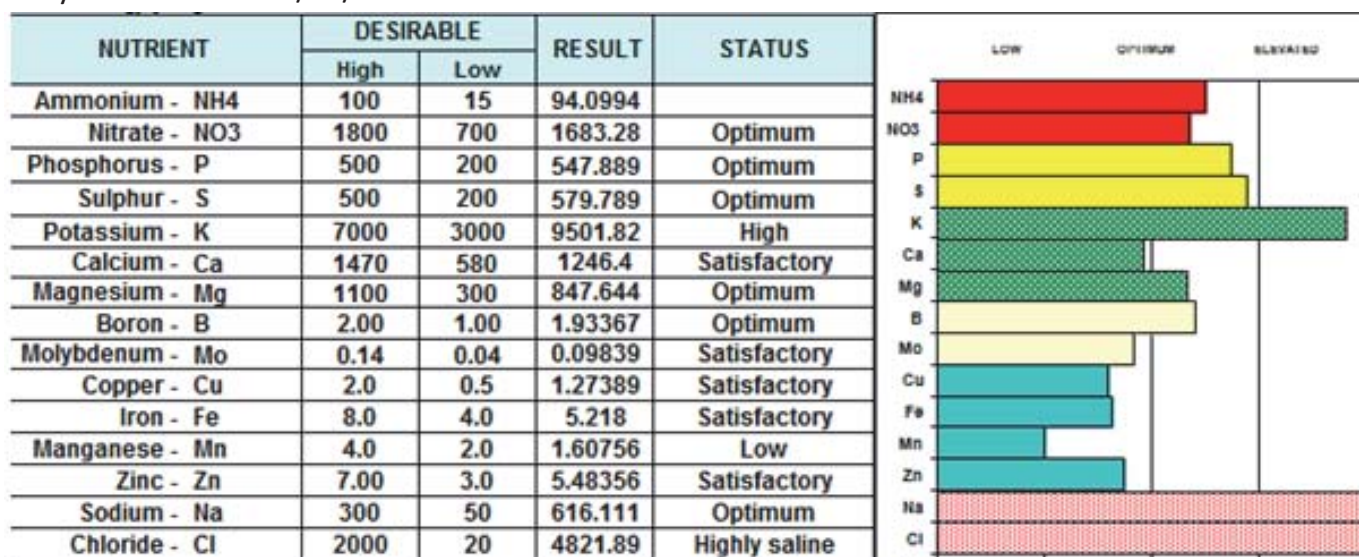
Prior to the initiation of the trial, all plots within the trial under went both soil and SAP analysis. This analysis was to formulate a baseline nutrient status which will allow nutrient shifts to be tracked throughout the life of the trial. With the exception of Potassium and Calcium all other soil nutrients are present at satisfactory levels. By monitoring the soil levels throughout the project we will be able to associate in reductions in these statuses to the relevant treatment.

Table 10: Soil nutrient analysis conducted on the Irrigated site before the initiation of the trial, test conducted 20/12/2011

Nutrient	Desirable Level (mg/kg)		Site Result (mg/kg)	Nutrient Status
	High	Low		
Phosphorus (P)	90	40	48.7	Satisfactory
Potassium (K)	320	195	63	Very Low
Sulphur (S)	45	12	22	Satisfactory
Calcium (Ca)	2200	1300	986	Low
Magnesium (Mg)	330	165	312.6	Satisfactory
Zinc (Zn)	8	1.6	4.49	Satisfactory
Iron (Fe)	200	30	68.9	Satisfactory
Manganese (Mn)	70	18	27.6	Satisfactory
Copper (Cu)	10	2.5	3.68	Satisfactory
Boron (B)	4	1.7	1.78	Satisfactory
Sodium (Na)	63	16	273	High
Chloride (Cl)	<200	-	412.5	Very High
pH H2O	7	6	7.26	
pH CaCl2	6.5	5.4	6.8	

Note: The desirable level and nutrient status listed in table 10 are based on soil properties and therefore they are not specific for the requirements of Lucerne crops

Figure 4: Lucerne SAP analysis conducted on the Irrigated site prior to the initiation of the trial, analysis conducted 20/12/2011



Note: The 'desirable and status' data in figure 4 above is based upon the nutrient requirements of Lucerne plants

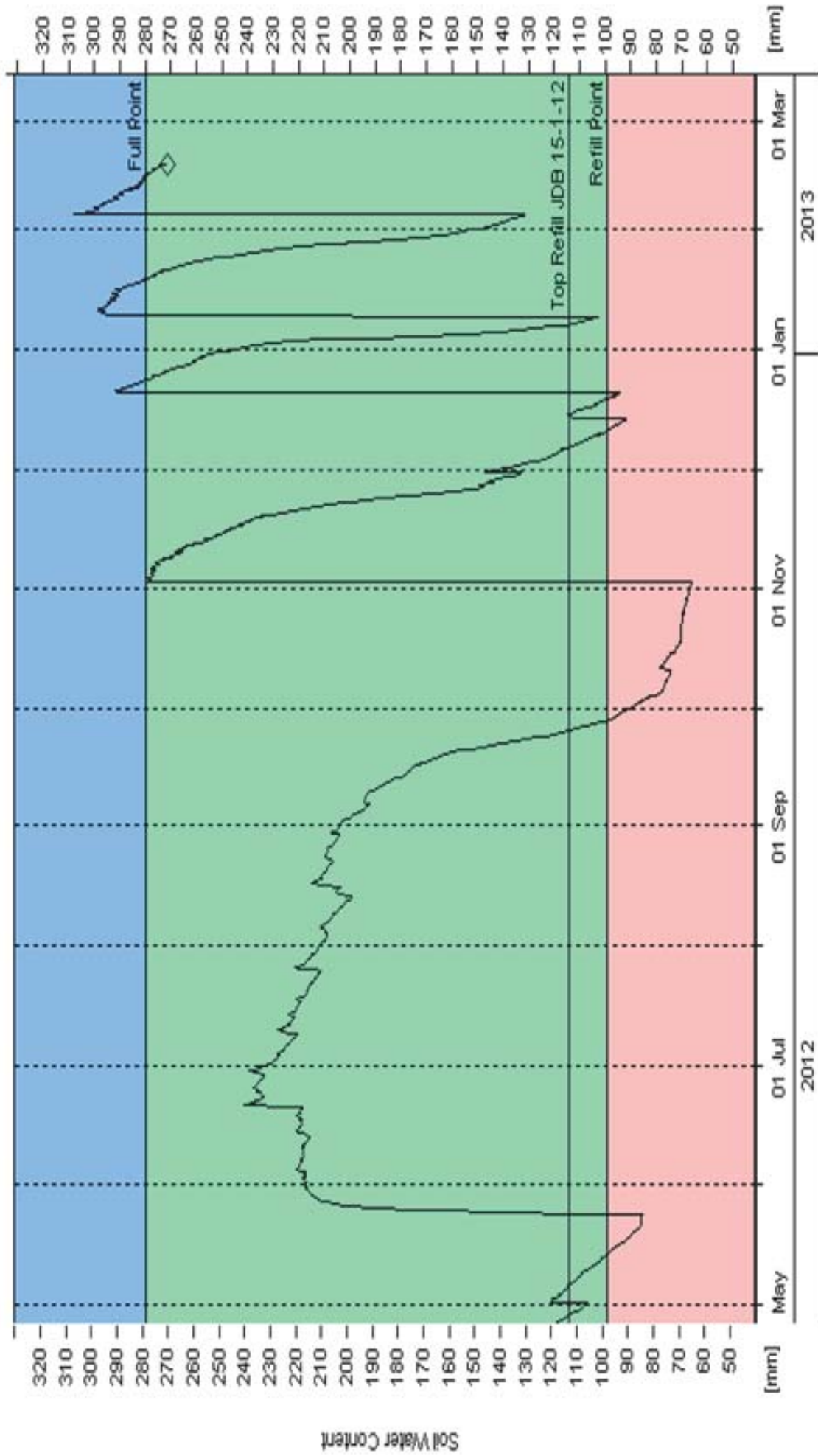


Figure 5: Soil moisture content of the Irrigated site for the 2012-13 season. The soil moisture graph is a summary of soil moisture sensors located at depths of 10, 20, 30, 40, 60 and 80cm below the soil surface. The graph gives an insight into the growing season rainfall which was well below average for the later part of 2012. The graph indicates that there was very minimal rainfall after the application of spring fertilisers on the 18th of September 2012 up until the first irrigation on the 2nd of November. The post hay cut application was applied 3 days before the second Irrigation.

Table 11: Irrigated Trial Site Results for 2012-13 Growing Season

Treatment No.	Treatment	NDVI	Yield	Relative gross margin (\$/ha)
1	Untreated Control	0.6694 a	966 a	4829
2	Scrub Mix (200kg/ha)	0.6666 a	984 a	4782
3	MAP S/SOP 2 & 1 (200kg/ha)	0.6761 a	985 a	4787
4	Plain Super (100kg/ha)	0.6819 a	1010 a	5012
5	Plain Super (200kg/ha)	0.6905 a	1009 a	4970
6	Plain Super (300kg/ha)	0.6944 a	1000 a	4891
7	Super Potash 2 & 1 (100kg/ha)	0.6835 a	918 a	4540
8	Super Potash 2 & 1 (200kg/ha)	0.6994 a	972 a	4764
9	Super Potash 2 & 1 (300kg/ha)	0.6852 a	994 a	4828
10	Sulphate of Potash (SOP)	0.6888 a	941 a	4612
11	Muriate of Potash (MOP)	0.6849 a	960 a	4733
12	Lucerne K 36 B 0.95% Zn 0.19%	0.7044 a	987 a	4855
13	Lucerne K 38 B 0.77% Zn 0.15%	0.6691 a	1012 a	4966
14	Lucerne K 31 B 1.25% Zn 0.25%	0.6852 a	1049 a	5179
15	Lucerne Mix 1 low cost(mix A)	0.6748 a	1058 a	5199
16	Lucerne Mix 2 high cost (mix A++)	0.7062 a	1045 a	5098
17	BioGraze	0.6957 a	966 a	4741
18	BioGraze 2 in 1	0.6937 a	968 a	4712
19	BioGraze 5 in 1	0.6838 a	995 a	4864
20	SS/SOP/Humate granules	0.6905 a	984 a	4766
21	Pig Manure	0.6981 a	1048 a	4982
22	NutriCal X3 + BioCoat	0.6893 a	1049 a	4973
23	NutriCal X2 + BioCoat	0.6906 a	1024 a	4857
24	NutriCal X2 + Scrub Mix	0.6825 a	971 a	4570
25	Chicken Manure	0.6826 a	973 a	4760
26	Compost	0.6898 a	984 a	4816
27	Foli-Zyme	0.6799 a	945 a	4578
28	Bio-Forge	0.6915 a	1025 a	4940
29	Booster Zinc Moly + Maxi Mang	0.6800 a	986 a	4796
30	Balance 3ZBM + Maxi Friut	0.6863 a	1043 a	5062
	LSD (P=0.5)	0.0500	90	
	Standard Deviation	0.0307	55	
	CV	9.84	5.55	

Note:

- Letters accompanying data within table 5 are 'letters of significance'. Although data may appear numerically different, all treatments with the same letter of significance cannot be considered significantly different.
- Seed yield has been measured and displayed on the basis of 99.9% purity of cleaned seed.
- Relative Gross Margin is calculated based on a clean seed price of \$5-00/kg. Plus an application cost of \$5-00/ha for granular, \$11-00/ha for liquids and \$20/ha for composts, but excludes freight. No other cost associated with producing the seed are factored in as these are considered constant across all treatments within the trial

Irrigated Trial Clean Seed Yield (kg/ha), 2013 Harvest

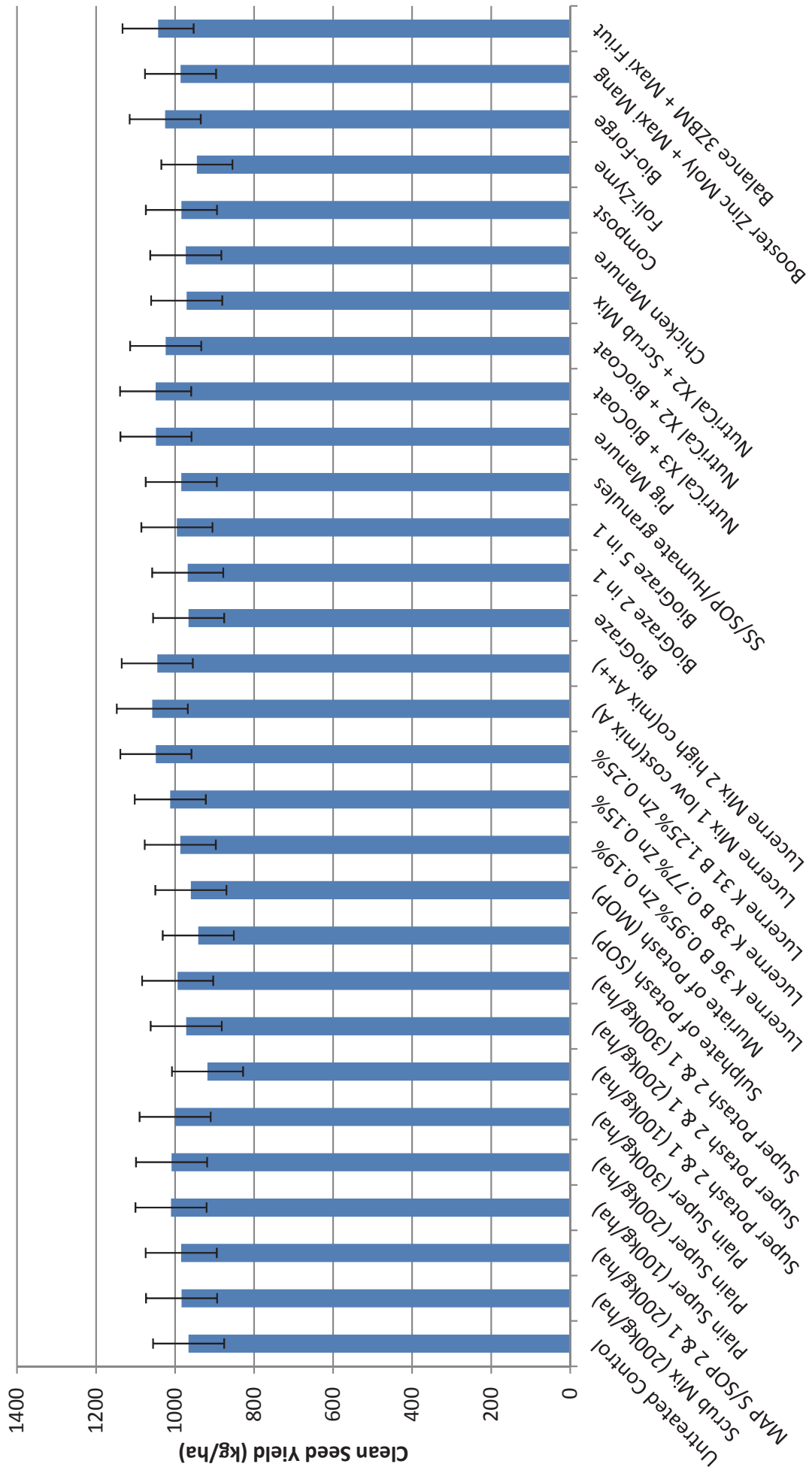


Figure 6: Clean seed yield for the Irrigated trial site 2013 harvest.

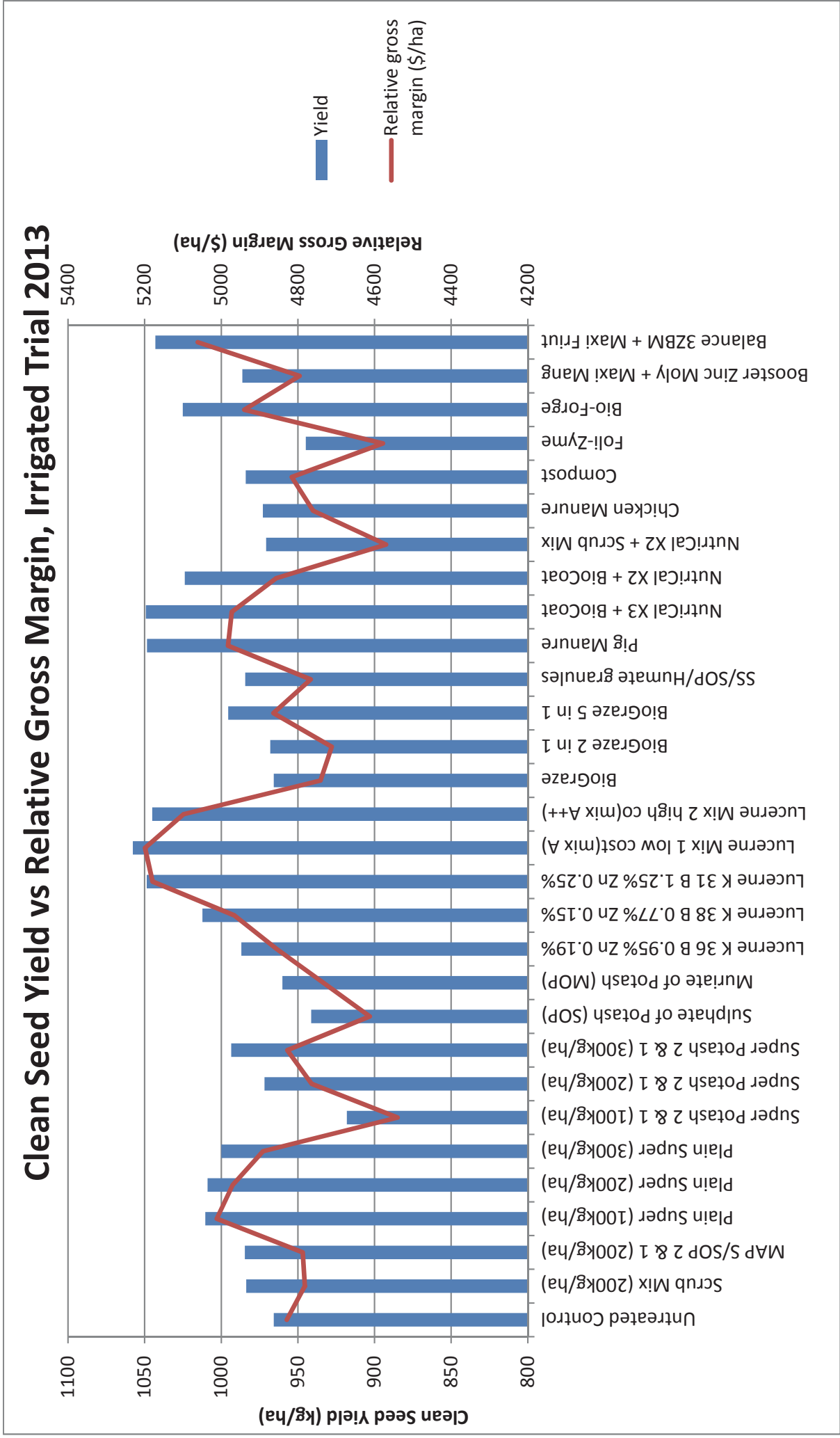


Figure 7: Clean seed yield vs relative gross margin of the Irrigated trial site for the 2013 harvest. Relative Gross Margin is calculated based on a clean seed price of \$5-00/kg. Plus an application rate of \$5-00/ha for granular, \$11-00/ha for liquids and \$20/ha for composts, but excludes freight. . No other cost associated with producing the seed are factored in as these are considered constant across all treatments within the trial. The blue bar graph above or below the red line does not indicate a surplus of deficit, just the relationship between the figures of the two items graphed .

Table 12: SAP Analysis Results, Irrigated Trial Site 2012-13 Growing season

Treatment No.	Name	NO3 (ppm)	P (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	Zn (ppm)	B (ppm)	S (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)	Mo (ppm)	Na (ppm)	Cl (ppm)
Optimum Range for Lucerne	Low level	700	200	3000	580	300	3.00	1.00	200	0.50	4.00	2.00	0.040	50	20
	High Level	1800	500	7000	1470	1100	7.00	2.00	500	2.00	8.00	4.00	0.140	300	2000
1	Untreated Control	251	372	7257	1074	1147	4.27	1.33	307	1.30	4.93	3.38	0.206	d	1179
2	Scrub Mix (100kg/ha)	171	464	7111	1236	1272	4.41	1.72	380	1.31	6.04	4.62	0.306	c	1493
3	MAP S/SOP 2 & 1 (150kg/ha)	193	421	7467	1404	1252	4.05	1.68	367	1.16	4.00	3.40	0.212	d	968
4	Plain Super (50kg/ha)	225	411	6652	1222	1169	4.05	1.71	322	1.12	6.74	3.92	0.214	d	1433
5	Plain Super (100kg/ha)	227	364	6897	1196	1082	3.69	1.34	294	0.99	5.73	3.47	0.163	d	1191
6	Plain Super (150kg/ha)	181	398	6726	1182	1249	3.65	1.71	340	1.11	6.57	4.22	0.237	d	1404
7	Super Potash 2 & 1 (50kg/ha)	176	455	7222	1283	1299	4.76	1.40	359	1.19	5.26	3.72	0.229	d	1284
8	Super Potash 2 & 1 (100kg/ha)	201	411	7261	1192	1157	3.80	1.16	338	1.09	5.88	3.82	0.262	d	1289
9	Super Potash 2 & 1 (150kg/ha)	174	413	6893	1158	1099	4.28	1.30	308	1.11	4.20	3.86	0.211	d	1464
10	Sulphate of Potash (SOP)	207	417	7149	1025	1076	4.03	1.85	344	1.13	4.93	4.06	0.205	d	1446
11	Muriate of Potash (MOP)	236	491	7876	1123	1332	4.57	1.52	374	1.14	5.59	3.61	0.279	c	1269
12	Lucerne K 36 B 0.95% Zn 0.19%	168	433	6757	1089	1155	4.14	1.42	329	1.11	4.60	3.68	0.268	c	1362
13	Lucerne K 38 B 0.77% Zn 0.15%	244	429	7859	1106	1196	4.67	1.42	375	1.09	4.99	3.00	0.239	c	1088
14	Lucerne K 31 B 1.25% Zn 0.25%	231	450	7636	1168	1170	3.99	1.48	352	1.21	6.16	4.31	0.262	c	1268
15	Lucerne Mix 1 low cost (mix A)	231	385	6583	1346	1094	3.80	1.04	317	1.01	5.49	3.64	0.354	b	1525
16	Lucerne Mix 2 high co (mix A++)	238	449	7253	1288	1149	4.34	1.41	326	1.18	5.10	3.79	0.625	a	1109
17	BioGraze	182	432	7359	1161	1158	4.49	1.54	376	1.25	4.60	4.40	0.314	c	1256
18	BioGraze 2 in 1	248	483	7156	1079	1190	4.52	2.50	375	1.36	4.95	5.07	0.313	c	1474
19	BioGraze 5 in 1	230	424	7119	1154	1135	4.09	1.52	319	1.11	4.62	3.98	0.246	c	1416
20	SS/SOP/Humate granules	267	383	7420	1045	1059	3.98	1.47	343	1.05	4.43	3.28	0.201	c	1148
21	Pig Manure	288	408	8026	1109	1120	3.85	1.01	327	1.04	5.45	3.24	0.310	c	1035
22	NutriCal X3 + BioCoat	207	393	6659	1275	1121	3.76	1.41	313	1.08	5.15	3.72	0.266	c	1441
23	NutriCal X2 + BioCoat	207	412	6773	1195	1082	4.00	1.47	312	1.13	5.52	3.99	0.279	c	1440
24	NutriCal X2 + Scrub Mix	269	440	7026	1302	1262	4.06	2.21	375	1.10	4.70	4.09	0.319	c	1205
25	Chicken Manure	239	427	7346	1184	1098	3.63	1.65	341	1.07	4.66	3.90	0.294	c	1159
26	Compost	166	463	6909	1077	1167	4.15	1.59	323	1.21	4.77	4.49	0.271	c	1608
27	Foli-Zyme	258	463	7557	1195	1192	4.27	1.51	340	1.15	5.54	3.58	0.269	c	1229
28	Bio-Forge	250	463	7885	1175	1253	4.47	1.54	378	1.20	5.44	3.87	0.313	c	943
29	Booster Zinc Moly + Maxi Mang	199	454	8055	1046	1240	4.35	1.10	356	0.99	5.76	3.23	0.390	b	1217
30	Balance 3ZBM + Maxi Fruit	264	418	7742	1280	1173	4.17	1.27	341	0.96	4.74	3.34	0.254	c	1003
	LSD (P=.05)	107	94	1039	307	189	0.80	0.82	63	0.29	1.49	1.25	0.104		448
	Standard Deviation	66	58	636	188	116	0.49	0.50	39	0.18	0.91	0.77	0.064		274
	CV	30	13	9	16	10	11.80	33.29	11	15.91	17.49	20.09	22.970	21	10

Note: Molybdenum was the only nutrient to show significant differences between treatments. The 'letters of significance' in the adjacent column indicate which treatments are different



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