A W R I

The Australian Wine Research Institute

Griffith grape marc mulch trial

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#newclimate

The AWRI

Project Outline

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Commenced: July 2012

Location: NSW Ag. Hanwood Research Farm

Variety: Shiraz PT23 on Ramsey rootstock

Trial Design: 6 treatments, 6 replicates

Trial Design

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Shiraz	Southern end														
Block	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
Panel 1		1	Buffer											1	1
Panel 2	1	2	2		6		4		3		1		5	2	2
Panel 3	2	2	2		6		4		3		1		5	2	2
Panel 4	2	2	2		6		4		3		1		5	2	2
Panel 5	2	2	2		6		4		3		1		5	2	2
Panel 6	2	2	2		6		4		3		1		5	2	2
Panel 7	2	2	Buffer											2	2
Panel 8	2	2	1		4		5		2		6		3	2	2
Panel 9	2	2	1		4		5		2		6		3	2	2
Panel 10	2	2	1		4		5		2		6		3	2	2
Panel 11	2	2	1		4		5		2		6		3	2	2
Panel 12	2	2	1		4		5		2		6		3	2	2
Panel 13	2	2	Buffer											2	2
Panel 14	2	2	5		3		6		4		2		1	2	2
Panel 15	2	2	5		3		6		4		2		1	2	2
Panel 16	2	2	5		3		6		4		2		1	2	2
Panel 17	2	2	5		3		6		4		2		1	2	2
Panel 18	2	2	5		3		6		4		2		1	2	2
Panel 19	2	2	Buffer											2	2
Panel 20	2	2	3		2		1		6		5		4	2	2
Panel 21	2	2	3		2		1		6		5		4	2	2
Panel 22	2	2	3		2		1		6		5		4	2	2
Panel 23	2	2	3		2		1		6		5		4	2	2
Panel 24	2	2	3		2		1		6		5		4	2	2
Panel 25	2	2	Buffer											2	2
Panel 26	2	2	6		5		3		1		4		2	2	2
Panel 27	2	2	6		5		3		1		4		2	2	2
Panel 28	2	2	6		5		3		1		4		2	2	2
Panel 29	2	2	6		5		3		1		4		2	2	2
Panel 30	2	2	6		5		3		1		4		2	2	2
Panel 31	2	2	Buffer											2	2
Panel 32	2	2	4		1		2		5		3		6	2	2
Panel 33	2	2	4		1		2		5		3		6	2	2
Panel 34	2	2	4		1		2		5		3		6	2	2
Panel 35	2	2	4		1		2		5		3		6	2	2
Panel 36	2	2	4		1		2		5		3		6	2	2
Panel 37	2	2	Buffer											2	2
Panel 38	2	2	Irrigation main line											1	2
Panel 39	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Treatments

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Treatment 1: Control

Treatment 2: Grape marc thick (3-4 cm thick) + NPK (250kg/ha)

Treatment 3: Grape marc thick

Treatment 4: Grape marc thin (half thick)

Treatment 5: Grape marc thin + chicken manure

Treatment 6: Mixed NPK fertiliser (250kg/ha)

Nutrient Analysis

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Nutrient	Grape Marc	Grape Marc + Chicken Manure	Typical (Average)
Nitrogen (N)	2.5	4.6	2.0
Potassium (K)	2.3	1.85	0.8
Sodium (Na)	0.01	0.07	<0.2
Moisture (%)	40	35	>25
Carbon to Nitrogen ratio	21.9	8.5	<15

NB. Carbon to Nitrogen ratio should be below 20, to ensure there is no nitrogen drawdown

Analysis done by Environmental Analysis Laboratory, Southern Cross University.

C: N ratio comparisons

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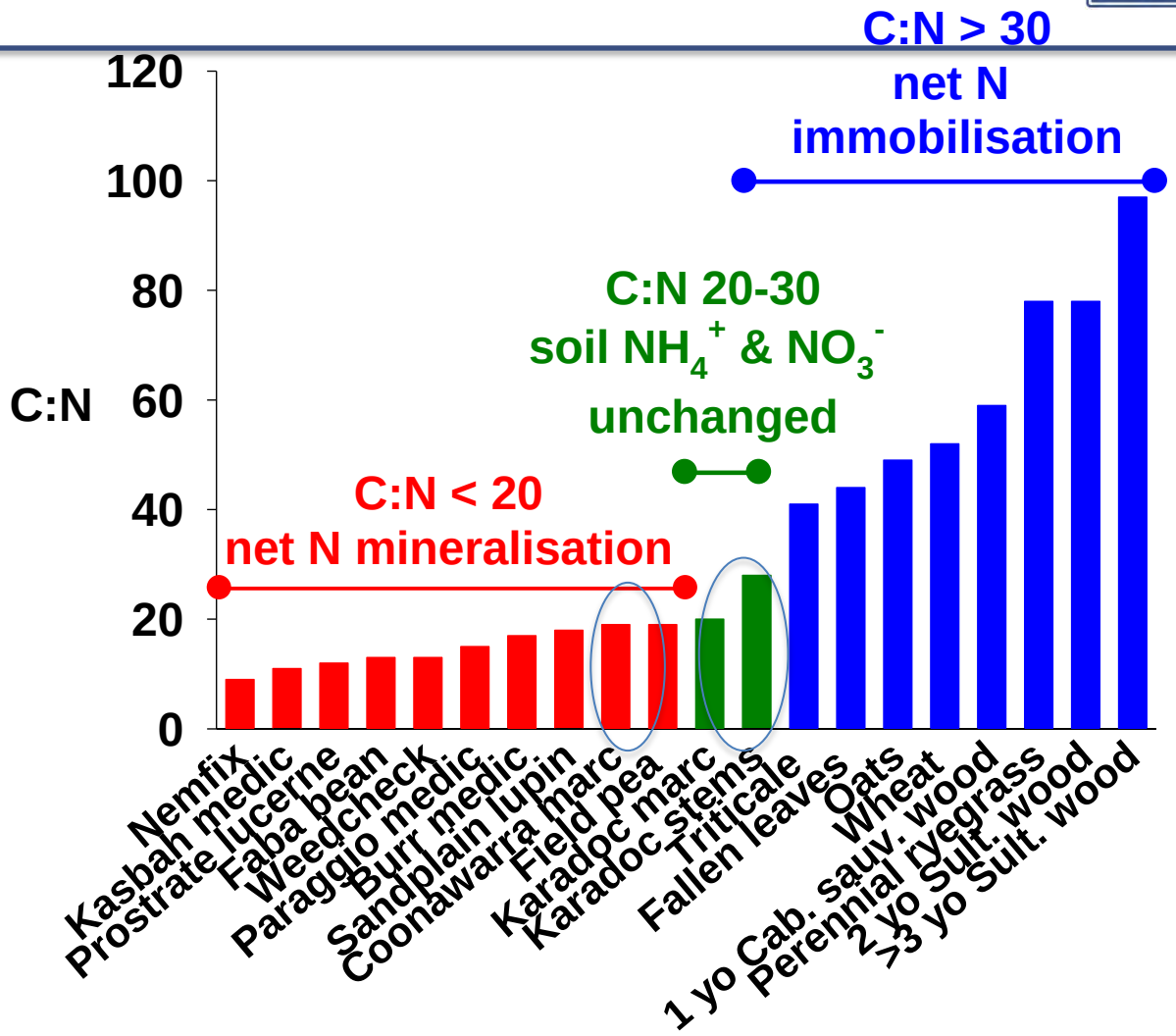

Taken from CSIRO presentation M. Treeby

Results

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- Soil temperature
- Soil moisture
- Soil chemical analysis
- Veraison petiole analysis
- Maturity – baume, pH/TA, Bunch weight, berry weight, Colour
- Yields
- Wine Analysis

Soil Temperature – First Year

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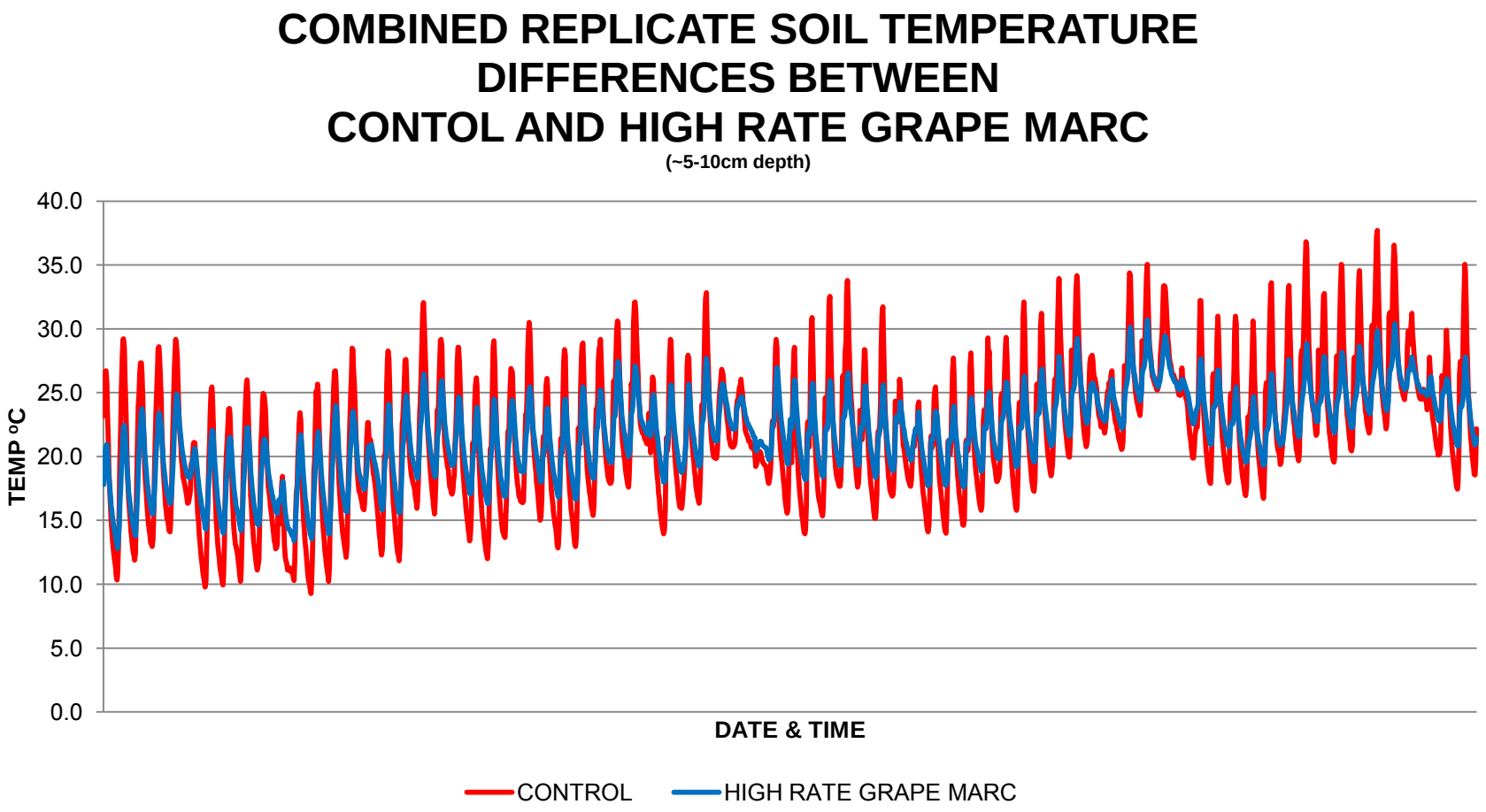

Soil Temperature – 2 Seasons

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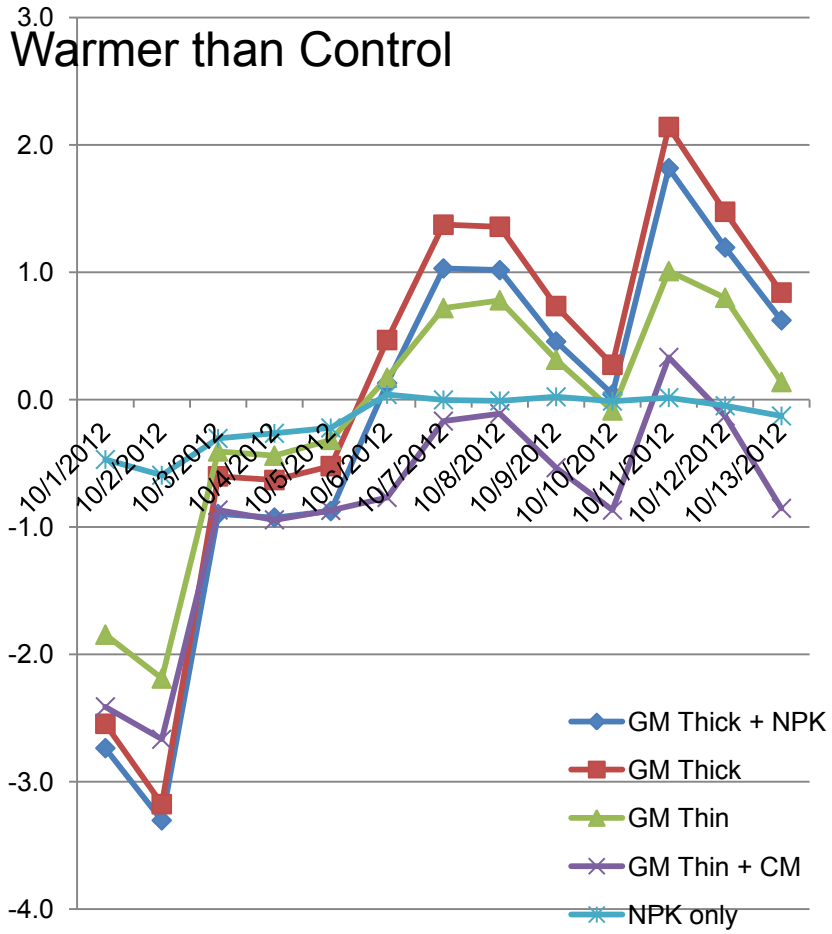
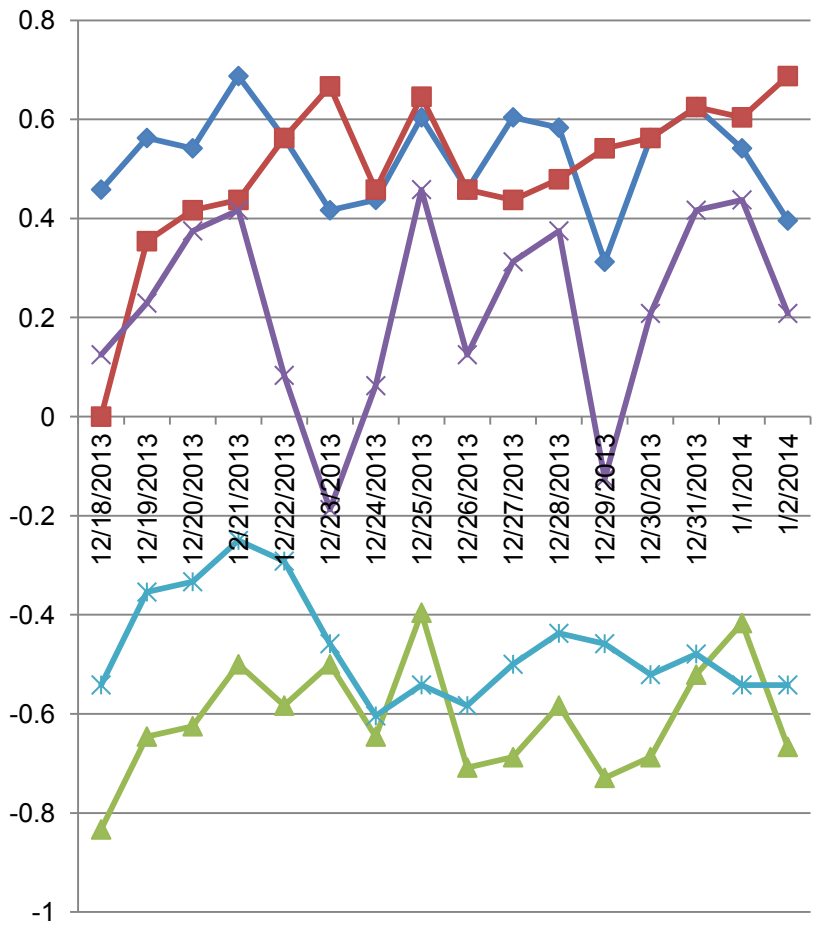


October 2012



December 2013

Soil Moisture

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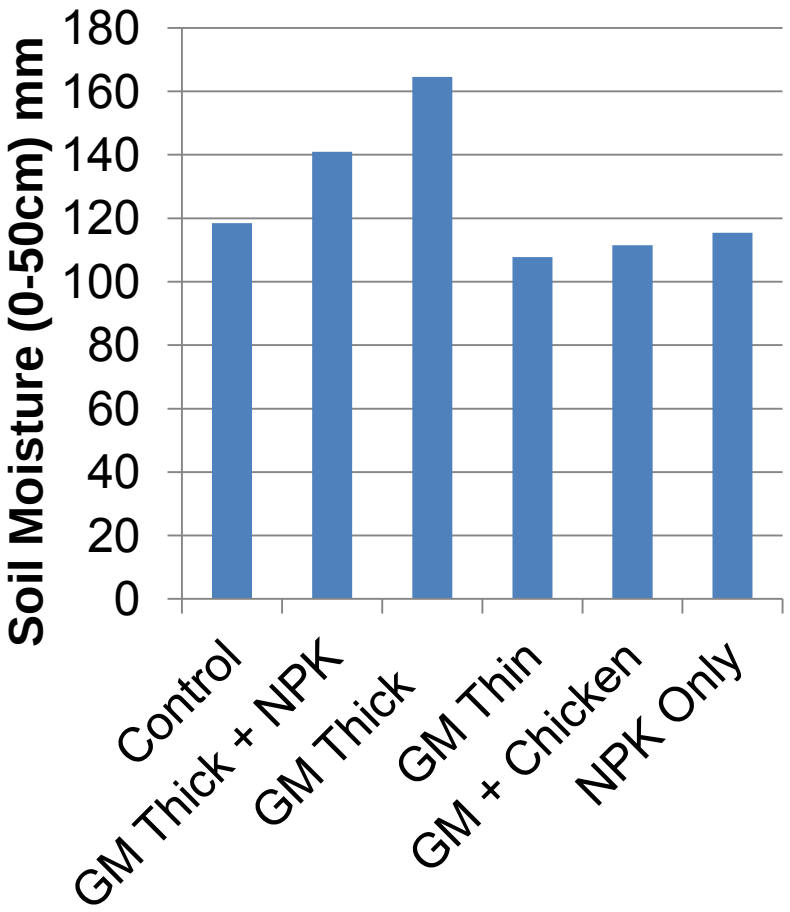

Thickly applied GM had greater soil moisture retention

Measurements taken on 19/11/12

Soil chemical composition

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		Treatment (October 2012)					
	Pre-Treatment (July 2011)	Control	GM Thick + NPK	GM Thick	GM Thin	GM thin + Chicken manure	NPK only
N (mg/kg)	6	0.73	0.82	0.85	0.85	0.63	0.57
P (mg/kg)	132.1	72	101.2	92.8	83.3	84.7	84.5
K (mg/kg)	153.6	98.8	116.2	100.3	106.0	109.7	103.5
Na (mg/kg)	25	55	59.8	60.8	54.7	49.2	56.3
Total C (%)	1.0	0.71	0.69	0.74	0.71	0.73	0.71
C/N (Ratio)	11.9	12.7	12.7	13.1	13.4	13.2	12.6

N (Nitrate Nitrogen, KCl), P (Bray P2), K (Morgan), Na (Ammonium Acetate), Total C (IR analyser), C/N Ratio (calculation)

Veraison Petiole

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	Treatment						
	Control	**GM Thick + NPK**	**GM Thick**	**GM Thin**	**GM thin + Chicken manure**	**NPK only**	**Sig**
N (%)	0.61d	0.76b	0.73bc	0.67cd	**0.94a**	0.65d	P<0.001
P (%)	1.08a	1.02a	1.00a	1.06a	**0.85b**	1.06a	P=0.002
K (%)	3.04c	**3.73a**	**3.47ab**	**3.50ab**	3.33bc	3.04c	P<0.001
Na (%)	0.10	0.09	0.10	0.09	0.10	0.08	n.sig
C:N Ratio	**64.9a**	51.7c	53.7c	58.1b	41.2d	60.0b	P<0.001
	15th January 2013						

Maturity Year 1(26/2/13)

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	Control	GM Thick + NPK	GM Thick	GM Thin	GM thin + Chicken manure	NPK only	Sig
Berry Weight (g)	1.24	1.27	1.27	1.30	1.2	1.28	n.sig
Baume	13.8	13.7	13.8	13.8	13.9	14.0	n.sig
Bunch Weight (g)	201	206	228	218	207	217	n.sig
Colour (mg/g f.w)	1.02a	**0.95b**	**0.99ab**	**0.97b**	**0.97b**	1.05a	P=0.02
pH	4.1	4.3	4.3	4.3	4.2	4.3	n.sig
TA (g/L)	3.5	3.5	3.6	3.5	3.7	3.9	n.sig
Yield (t/ha)	16.2	16.4	17.1	15.1	15.3	14.0	n.sig

Maturity Year 2 (4/2/14)

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	Control	GM Thick + NPK	GM Thick	GM Thin	GM thin + Chicken manure	NPK only	Sig
Berry Weight (g)	1.1	1.2	1.1	1.1	1.04	1.2	n.sig
Baume	13.6	12.8	12.9	13.0	13.2	13.1	n.sig
Bunch Weight (g)	95.2	106.7	114.8	108.1	106.7	100.5	n.sig
Colour (mg/g f.w)							
pH	3.6	3.7	3.7	3.6	3.7	3.6	n.sig
TA (g/L)	4.7	4.9	4.9	4.8	5.0	4.7	n.sig
Yield (t/ha)	10.2	12.1	12.2	12.2	12.3	11.7	n.sig

Wine Analysis

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	Wine pH		Wine TA (G/L)		Alcohol		K
	2013	**2014**	**2013**	**2014**	**2013**	**2014**	**2013**
Control	3.79ab	3.62b	5.8b	5.9	14.57b	14.5	1390.2bc
GM Thick +NPK	3.77cd	n/a	**5.9a**	n/a	14.58b	n/a	1415.9b
GM Think	3.78bc	3.65b	**5.9a**	5.8	14.33c	14.0	**1483.6a**
GM Thin	**3.80a**	**3.70a**	**5.9a**	5.7	14.50b	14.2	**1513.4a**
5GM Thin + Chicken	3.72e	n/a	5.6c		14.25c		1260.6d
NPK Only	3.76d	n/a	5.8b		**14.86a**		1356.3c
Sig	P<0.001	P<0.05	P<0.001	n.sig	P<0.001	n.sig	P<0.001

Weeds

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- It was reported that weed growth was present in all treatments
- Where GM had been applied thickly the presence of weeds was reduced

Costs

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- Delivery and application estimated to be $15/t
- Hire rate for spreader ($300/day), may be additional loading fees as well
- Freight $5-10/T depending on distance

Conclusions

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- Reduced fluctuation in topsoil temperature – promotes a more even temperature regime for root survival and fruit ripening.
- Improved soil moisture retention early on.
- Reduced weed growth – less herbicide reliance
- Important to know the nutrient analysis of mulch/compost being applied, N, K and C:N ratio in particular
- Potentially more useful if used to even up variation, so selectively placed in known areas of weakness.

Mulch trials in other regions

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- Chris Penfolds 'Herbicide Reduction Strategies for Winegrape production' UA 00/1. (Full report can be obtained from AGWA website)
- Undertaken in 2001 and 2002
- Treatments:
    1. jute matting
    2. straw
    3. green organic compost
    4. grape marc compost
    5. grape stalks
- Minimally pruned Chardonnay

Banrock Station weed control

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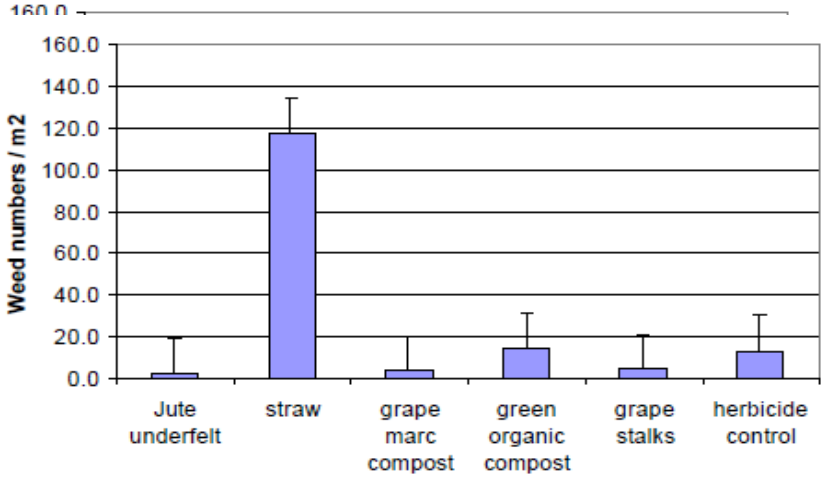

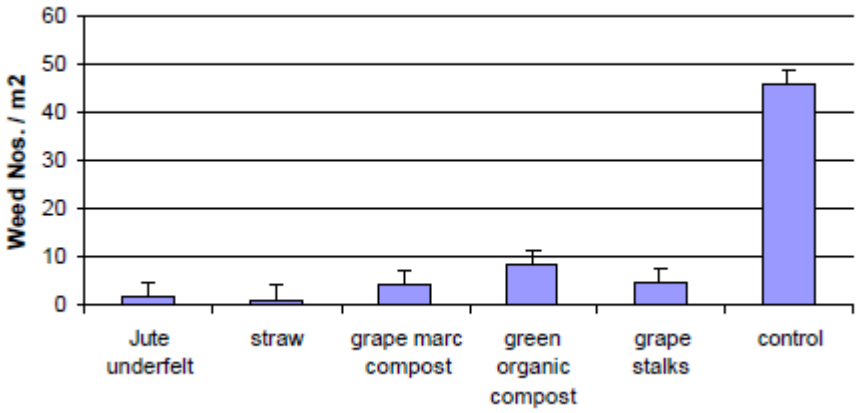

- Highlights the need to make sure seed bank within mulch source is low (2001)
- Straw in 2002 provided the most effective control of weeds

Yield and Pruning Weights

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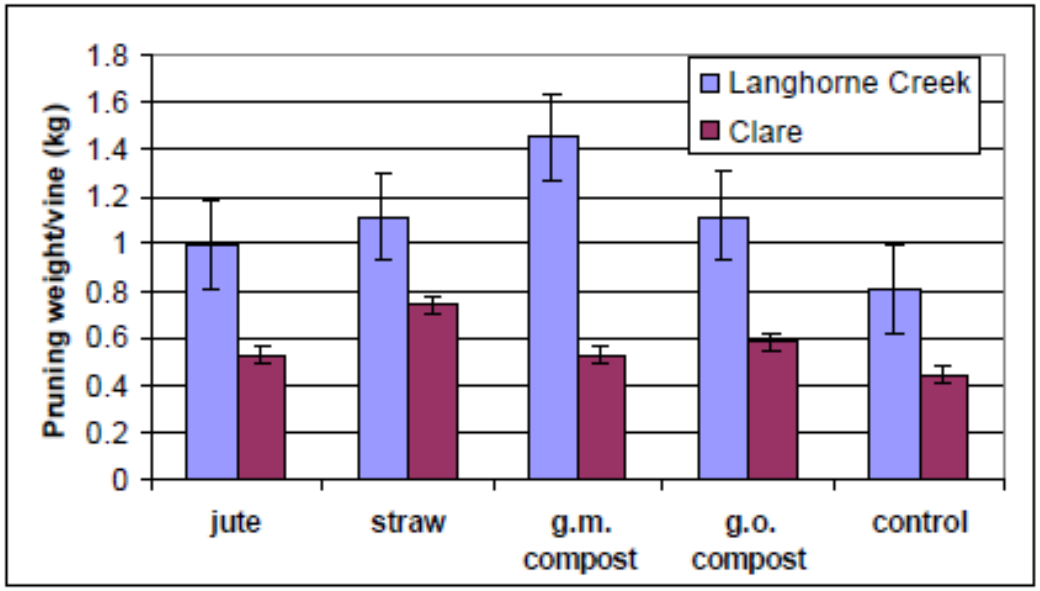

- Yields were not statistically different between treatments
- explained by the masking of any nutritional or soil moisture benefits due to large water volumes and fertigation to satisfy nutritional requirement

Soil Chemistry

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	P	K	EC
Jute	-2	-30	57
Straw	1.5	-9	57
Grape Marc	**63**	**147**	**187**
Green Organic Compost	2.7	**63**	**116**
Grape Stalks	-18	**124**	74
Control	-16	-22	27

% Change from before treatments applied until 21 months later (Bold letters indicate significantly different)

- The rise in EC was explained by the ability of mulches to prevent water reaching the soil, particularly after small rainfall events.
- K increased the soil (grape marc contained 3% K)