

2003
Evaluation of Microbiological Feedstock's and
Inoculation on Zinfandel Winegrape Performance and Water Relations

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Background

It has been reported that these products optimize plant performance by restoring beneficial microbial activity to soil. Results have shown improvements in vine health and wine character. Deficit irrigation practices have shown also shown significant improvements in wine character and color. Claims have been made that with the use of these materials the vine can better withstand water stress allowing the benefits of deficit irrigation and improved vine health. This study seeks to determine this relationship.

Objective

Evaluate the effects of microbiological feedstock's and inoculation on winegrape performance and water relations.

Methods

Treatments will consist of three levels of irrigation each with and without injected material to make a total of six treatments. Each treatment is replicated four times in a randomized complete block design. Treatments are:

- 1) Full potential irrigation without injection
- 2) Full potential irrigation with injection
- 3) Irrigation threshold of -13 bars followed by 50 % of potential use. w/o injection
- 4) Irrigation threshold of -13 bars followed by 50 % of potential use with injection
- 5) Irrigation threshold of -13 bars followed by 35 % of potential use w/o injection
- 6) Irrigation threshold of -13 bars followed by 35 % of potential use with injection

The strategy used in this trial is called "Deficit Threshold Plus RDI Irrigation Management." It relies on a midday leaf water potential threshold indicating when to begin irrigation. After the threshold is reached, a portion of full potential vine water use is applied as per the treatment schedule. All deficit treatments (3-6) were irrigated using the same strategy, -13 bar threshold. Treatments 3 and 4 were supplied 50% of full potential water use while treatments 5 and 6

received 35%. Injection treatments were with injection and without across each of the irrigation strategies.

The site is the Thompson vineyard located at the intersection of Highway 12 and Tecklenberg Road, Lodi, California. It satisfies the research criteria needed to create stress at various stages of vine growth and maturity. The zinfandel vineyard established on Freedom rootstock, is mature and bilateral cordon trained at 7 x 10 foot spacing. The experimental area contains 750 vines.

The soil at the site is a Tokay fine sandy loam, which has a moderate water-holding capacity. A drip irrigation system is used to deliver water to each replicated treatment independently. The well water supply is of good quality and contains less than 150-ppm total dissolved solids. Treatments are 3 rows wide and 8 data vines with border vines between plots.

2003 Field Operations

Bud break occurred on March 21st following a less than normal rainfall winter. Total available water stored in the root zone was projected to be in the 5–inch range. Spring brought greater than normal in-season (after bud break) rainfall equaling 3.5 inches of effective rainfall. Effective rainfall is the portion of the total rainfall, which is absorbed into the soil for later use. Application of Ceres, LiquiComp, and Concentrate began April 30 with a total of four applications for the season ending on November 13 (Table 1). A seasonal total of 16 gallons of Ceres and 31 gallons of Ceres and 10 gallons of Concentrate were applied. Each application was preceded by enough water to pressure up the lines and followed by a minimum of 25 minutes of run time to evenly distribute the injected material and flush the lines.

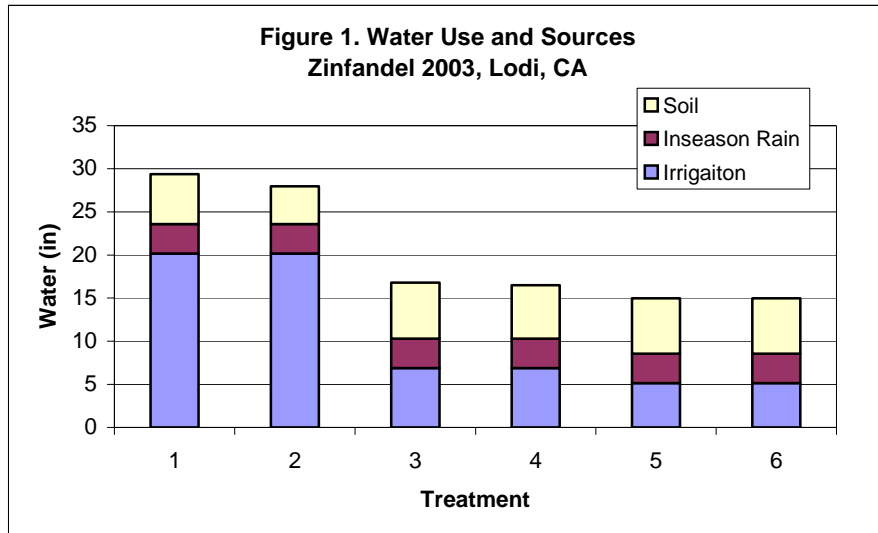
Table 1.

	Ceres (gal)	LiquiComp	Conc. (gal)	Water (gal)	Time (min)
30-Apr	4	4	2	20	55
12-Jun	6	6	4	14	35
30-Jul	6	6	4	14	25
13-Nov	0	15	0	15	30

Note: All material applications were followed by water to flush the system; an equivalent amount of water was given to the non-treated plots.

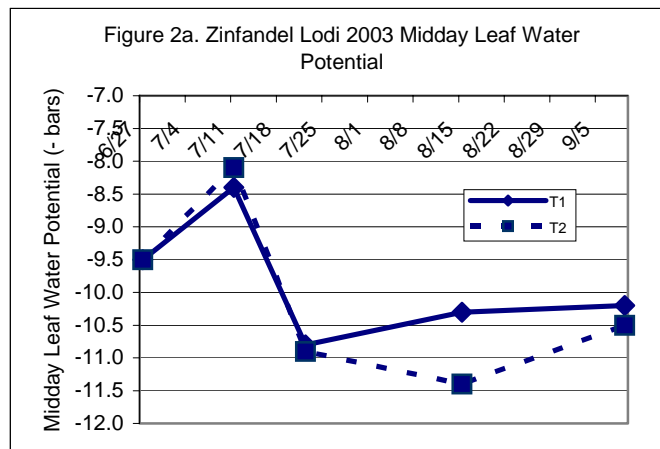
Water Use

The full potential water use treatments consumed 29 inches on a seasonal basis. Treatments 3 and 4 consumed 17inches while treatments 5 and 6 consumed 15 (Figure 1). In-season effective rainfall was 3.4 inches of the total while the soil contributed between 4.4 and 6.4 inches, depending on treatment. Irrigation volumes were 20 inches in Treatments 1 and 2. Treatments 3 and 4 were supplied with 7 inches while Treatments 5 and 6 received 5 inches.



Leaf Water Potential

Midday leaf water potential data were collected from each treatment. Measurements were made from 11:00 am to 2:00 pm on clear sky days with normal (85-95 °F) temperatures. Data presented below are grouped into threshold and RDI for comparison. The full potential irrigation (T1) was irrigated beginning May 16 and weekly thereafter at an amount to equal full potential water use each week. The leaf water potential continued to increase in stress until the threshold of -13 bars was exceeded in all treatments on July 22nd with the exception of the full potential treatment. Irrigation then commenced in the deficit treatments at the RDI level of each treatment. Midday leaf water potential measurements continued until one week before harvest. Note the increased level of water stress measured in the comparative treatments with material applied across all treatments Figures 2a, 2b, and 2c. When comparing the no injection treatments of the mild (50%) and the moderate (35%) deficit treatments, the recovery in MDLWP after the threshold is what would be expected. The mild deficit recovered over 2 bars while the moderate deficit recovered less than 1 bar.



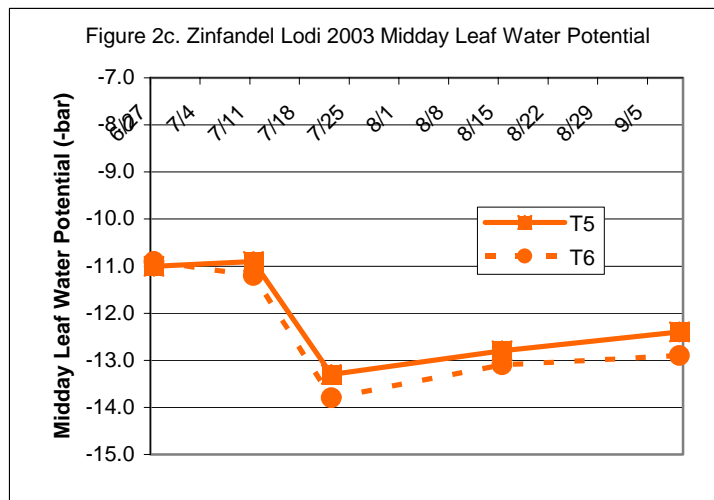
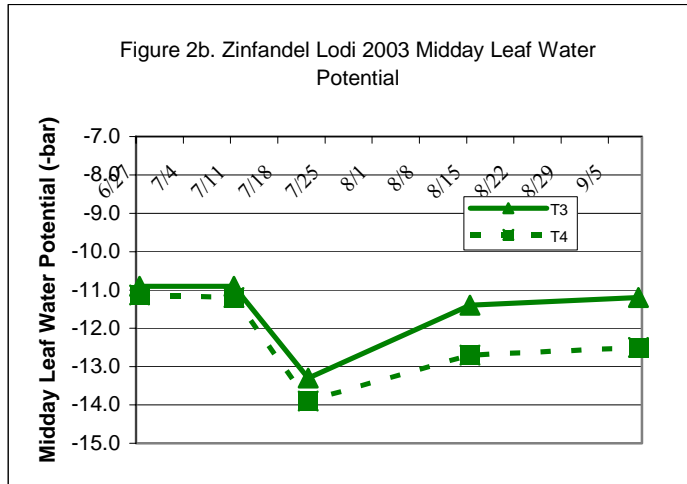
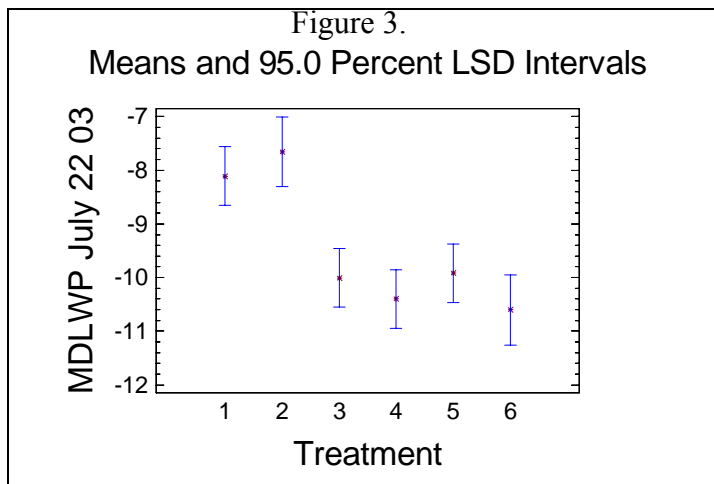


Figure 3 shows the leaf water potential at the July 22 reading when the deficit treatments exceeded the threshold. Note the slight increase in leaf water potential in the injection treatments over the no injection comparison treatments.



Yield

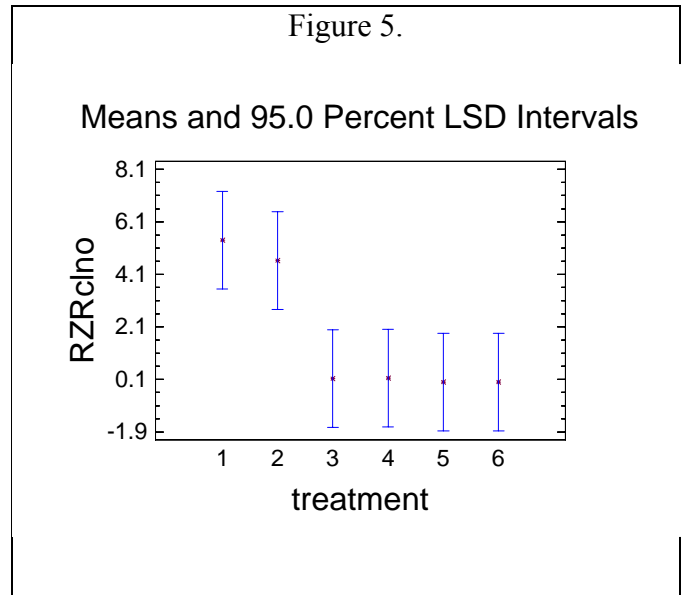
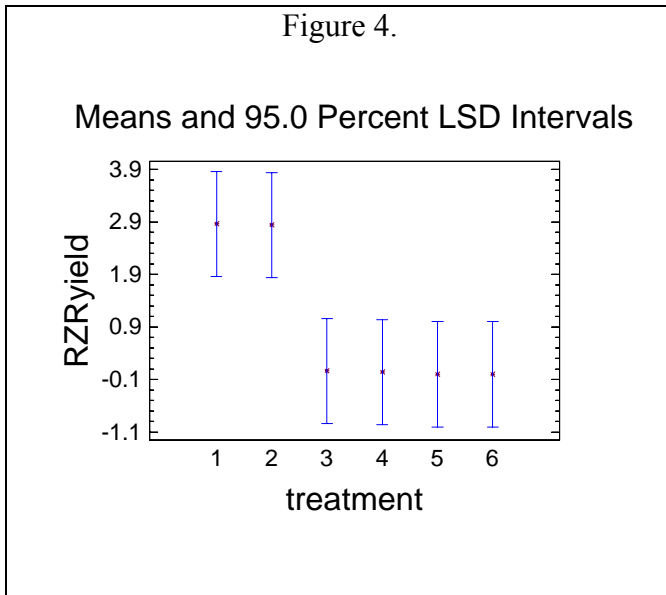
Harvest occurred over a 3-day period of time from September 16-19 2003. Essentially all treatments were ready to harvest based on sugar content at the same time. This was a typical result for this region this year but not typical every year. No differences in yield were measured between treatments (Table 2). Berry size was significantly larger in the full water treatments. The amount of rot was significantly higher in the full water treatments (Table 3 and Figure 4). If one added the total production of good fruit and rotten fruit the full water treatments produced significantly more total fruit by virtue of the larger berries and higher cluster per vine (Figure 5).

Table 2. Zinfandel Yield 2003 Harvest, Lodi, California
Rot-Free Results

Treatment	Yield lbs/vine	Clusters/ Vine	Cluster Wt lbs/cluster	Berry Load berry/vine	Berry Size gm/berry
1	21.4	50.9 c	0.42 ab	6448	1.81 ab
2	21.4	49.1 bc	0.44 a	6565	2.04 a
3	22.7	65.7 a	0.34 bc	8670	1.61 bc
4	22.3	61.7 abc	0.36 bc	8470	1.55 bc
5	21.2	60.0 abc	0.35 bc	8781	1.48 c
6	20.9	63.1 ab	0.33 c	9636	1.51 bc
P =	0.9923	0.0432	0.0242	0.2548	0.0046

Table 3. Zinfandel Yield 2003 Harvest, Lodi, California
Rot Results

Treatment	Rot Yield lbs/vine	Rot Clusters/Vine
1	2.86 a	5.40 a
2	2.84 a	4.60 a
3	0.06 b	0.13 b
4	0.04 b	0.16 b
5	0.00 b	0.00 b
6	0.00 b	0.00 b
P =7	0.0080	0.0124



Juice Analysis

Significant differences between treatments were found in Brix, titratable acidity and malic acid content (Table 4 and Figures 6, 7 and 8). Differences were found between the full water treatment and the deficit treatments. However the titratable acidity (figure 7) was increased for the injection treatments over the comparable non-injection treatments. This difference remains when using Brix as a covariate. Malic acid content was typically reduced by about 50% in the deficit treatments when compared to the full water treatments.

Table 4. Zinfandel 2003 Harvest, Lodi, California
Juice Analysis

Treatment	Brix	TA	pH	Malic Acid
1	28.3 a	6.4 b	3.64	3553 a
2	27.9 ab	6.2 b	3.63	3291 a
3	25.9 c	6.7 ab	3.68	1751 b
4	26.7 abc	7.1 a	3.64	1745 b
5	25.5 c	6.7 ab	3.57	1385 b
6	26.4 bc	6.8 ab	3.58	1330 b
P =	0.0293	0.0629	0.7323	0.0000

Figure 6

Means and 95.0 Percent LSD Intervals

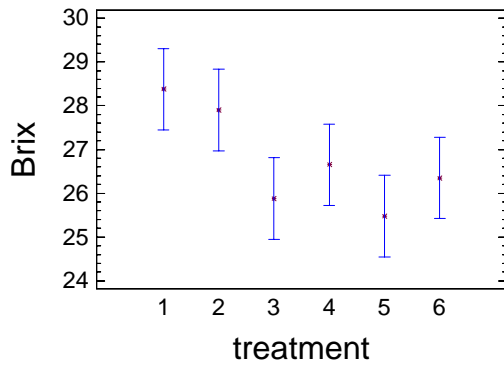


Figure 7

Means and 95.0 Percent LSD Intervals

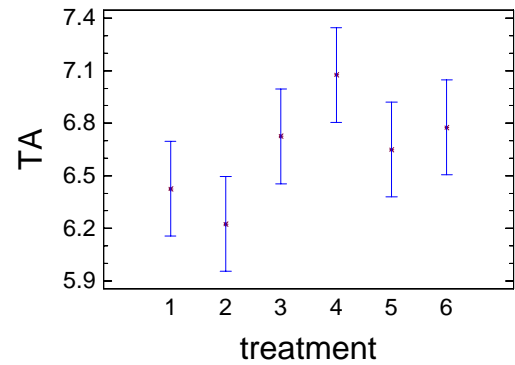
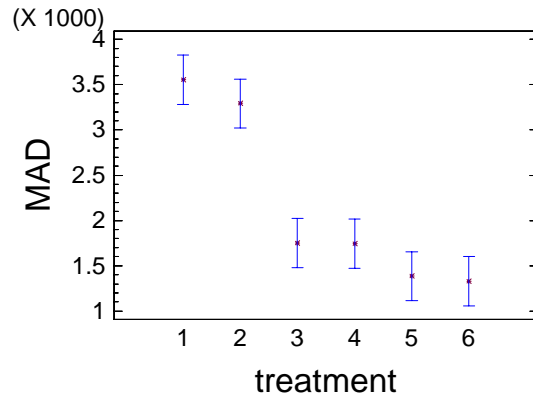


Figure 8

Means and 95.0 Percent LSD Intervals



Wine Analysis

Wine pH decreased as water stress increased. Greater differences occurred between the irrigation treatments than between injection treatments. Wine intensity also increased with water stress. The injection treatments averaged 0.2 units higher in each of the stressed treatments. Titratable acidity decreased with increasing water stress, as a result of the lower malic acid content of the juice. Little difference was noticed in the 280 nm spectrum in any treatment. Wine intensity (420/520nm) was increased in the deficit treatments over the full water treatments. The injection treatments improved 2 to 3 units over the non injection treatments at both deficit levels.

Table 5. Wine Analysis

Treatments	Alcohol (%v/v)	Tartaric acid added (g/l)	Titrateable Acidity (g/l)	pH	Volatile Acidity (g/l)	Abs. 280 (Phenols)	420/520 (Hue)	420+520 (Intensity)	Skin contact days
Full water w/o material (T1)	15.1	–	5.8	3.99	0.78	46	0.70	4.2	14
Full water w/ material (T2)	15.0	–	5.6	3.94	0.77	44	0.69	4.0	14
Mild deficit w/o material (T3)	15.1	–	5.2	3.84	0.88	43	0.69	4.4	14
Mild deficit w/ material (T4)	14.8	–	5.2	3.86	0.80	44	0.69	4.7	14
Moderate deficit w/o material (T5)	14.4	–	5.1	3.74	0.72	44	0.64	5.0	14
Moderate deficit w/ material (T6)	14.3	–	5.1	3.82	0.71	45	0.67	5.2	14

Organoleptic Wine Analysis.

TBA

Summary:

TBA