

# Controlled Cultural Reduction in Fruit Set and Subsequent Harvest Season *Botrytis* Cluster Rot Complex

## Final Report

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### **ACCOMPLISHMENTS TO DATE:**

**Year-1.** Vignoles vines subjected to 0 to 6 basal leaves removed at trace bloom showed the following responses: a) % fruit set was 60, 45 and 35% respectively and cluster weight, and berries/cluster were similarly reduced; b) the basal cluster was more reduced than was the apical cluster; c) reduced fruit set yielded reduced berry compactness within the cluster; d) reduced within cluster berry compactness resulted in reduced harvest season cluster rot due to *Botrytis* infection; e) the reduction in fruit set also reduced yields/vine; and f) reduced yields resulted in improved fruit maturity (based on fruit composition values) on leaf removal treatments.

**Repeated Experiment.** A second year of experimentation on Vignoles vines not previously defoliated has confirmed the efficacy of this approach and the control (within a given cultivar) the producer has in predicting % reduction in fruit set based on number of leaves removed at trace bloom. The amount of reduction in fruit set with a similar number of leaves removed will vary with cultivar. One can compensate for the crop reduction noted in the first year by simply retaining additional nodes at pruning time.

### **Year-2 Response of Vines Defoliated in Year 1.**

The removal of the leaf very early in the growing season has been demonstrated to have negative influence on the performance of the buds at that node the next season. In year-2 vines defoliated in year-1 were assessed for their response. These vines were not subjected to any leaf removal in year-2.

The responses to year-1 defoliation at trace bloom were: a) increased numbers of nodes producing no shoot; about 30% more for defoliated treatment vines. We cannot assess whether this is related to reduced bud cold hardiness, bud necrosis or possibly a bit of each; b) reduced numbers of clusters per shoot and per vine; c) the clusters produced had 10% fewer florets than did controls; d) % fruit set was considerably reduced (80%) on vines with most leaves removed in year-1; e) reduced shoots plus reduced clusters/shoot, reduced florets/cluster and reduced % fruit set resulted in greatly reduced yield.

Thus, unless these negative impacts of the Year-1 defoliation on Year-2 vine response can be ameliorated, this approach to the problems of cluster compactness and harvest season cluster rot will not be acceptable. We address this problem in approaches that will be evaluated in the fourth year (see Figure 1) and by employing a transient inhibition of photosynthesis at trace bloom, potentially achieving short-term source-sink imbalance without long-term loss of leaf function (Tables 1,2; Figure 2). This has shown promise with the herbicide Terbacil which blocks photosystem II. In fairness, the likelihood of this material being approved for this purpose seems very remote. Of greater potential is the data we have accumulated using spreader-stickers associated with fungicide and insecticide application. Similarly, the work in Virginia on JMS Stylet Oil (an approved organic insecticide) suggests that materials capable of blocking stomatal function could accomplish this short-term photosynthesis inhibition goal.

**Year-3.** Vignoles and Pinot noir vines were subjected to four spray application treatments (JMS Stylet Oil, Surround WP, R56 and control) at trace bloom.

- 1) Photosynthesis measurements were taken on Vignoles with a Cirrus II unit at the following times: one day before, one day after, and thirteen days after spray application. JMS Stylet Oil reduced photosynthesis ( $F \leq 0.01$ ) one day after spray application, this response ceased after thirteen days (See figure 3).
- 2) Pinot noir vines showed the following responses: a) control treatment had a significantly higher cluster compactness than the R56 and JMS Stylet Oil ( $F \leq 0.01$ ): the control had significantly more berries per cluster than R56 and JMS Stylet Oil ( $F \leq 0.01$ ), and the control had a significantly higher cluster weight than JMS Stylet Oil ( $F \leq 0.01$ )  
(See table 5).

**Year-4.** The fourth year of this effort included three experiments on the cultivars Vignoles, Pinot gris and Pinot noir. The efforts involved the following:

- 1) Determine whether the application of stylet oil shown to inhibit Pn in Year-3 would do so in 2005 and if so, whether the duration of transient inhibition of photosynthesis by the JMS stylet Oil could be extended by additional applications at and near trace bloom.
- 2) Evaluate the relationship between defoliation & spray application at trace bloom.
- 3) Conduct defoliation at trace bloom on the additional cultivars Pinot gris and Pinot noir.
- 4) Assess whether a training system that allowed canes arising at the head to be retained as year-2 "bearers" which would be defruited in year-1 and all leaves retained (Figure 1). Such canes would be retained at pruning to produce the next season's crop. Importantly this has not been tested and is also part of the proposed effort for 2005.

Tables 1-7 show data from the 2005 season and Figure 2 provides visual evidence for the impact of treatments on reduction of cluster compactness in Vignoles.

### **Vignoles 2005.**

The response of Vignoles to stilet oil application was not effective as expressed on a whole vine basis (Table 1) in 2005. The leaf removal at trace bloom continued to be effective in reducing cluster compactness (Tables 1&2). Support for this position comes from the assessment of yield reduction seen in previous years, reduced cluster weight resulting directly from a nearly identical reduction in Berries/Cluster. Importantly, *Botrytis* infection (Table 2) showing a continued significant reduction in infection on the leaf removal treatment. Stilet oil did lower Pn but not long-term.

Evaluation of Vignoles vines converted to VSP training suggested that the “bearer canes” concept, as suggested in Figure 1, had merit. The Figure 1-2005 plot of Pn over time suggested that while there were indications of a reduction in Pn resulting from the application of stilet oil, the impact was small in 2005.

### **Pinot gris 2005.**

The Pinot gris effort was aimed at expanding the data set on leaf removal at veraison to valuable *vinifera* cultivars where leaf removal is already a commercial practice, but employed later in the season. In this experiment leaf removal was also employed at trace bloom, but with a 6-basal leaf removal treatment to join the 4-leaf treatment. Leaf removal at trace bloom reduced cluster compactness in a manner similar to that of previous years (Tables 3&4). Both leaf removal treatments reduced Cluster Weight, Berries/Cluster, and the Cluster Compactness Index. These provide evidence for compactness reduction and, most importantly, the impact of the 6-leaf treatment was a strong, significant reduction in *Botrytis*.

### **Pinot noir 2005.**

The Pinot noir data indicate a minimal response to basal leaf removal at trace bloom (Tables 5&6). This may mean that Pinot noir is lacking in response or, more likely, the highly variable status of Pinot noir vines in the plot made it impossible to perceive differences. There is also the potential concern that the treatment may result in an increase in average berry weight, a real concern for light pigmented Pinot noir.

**Table 1-2005.** Response of Vignoles Grapevines to Either Four Basal Leaves Removed (4LR) or Spray Application of Stylet Oil at Trace Bloom on Two or Three Subsequent Sprays.

Measurements	Treatments					F
	Control	4-LR	SO-1	SO-2	SO-3	
Initial Vine Size (kg)	1.1	1.2	1.1	1.2	0.92	ns
Nodes Retained	64	64	64	64	64	ns
Yield (kg/vine)	4.9a	2.8b	5.5a	5.8a	3.8a	**
Yield (T/A)	3.25a	1.85b	3.64a	3.85a	2.50b	**
Cluster #/vine	50	43	38	47	36	ns
Mean Cluster Wt (g)	128a	78b	121ab	134a	121a	*
Berry Weight (g)	1.5	1.4	1.4	1.6	1.5	ns
Berries/Cluster	86a	56b	85a	85a	80a	*
Cluster/Shoot	0.8	0.7	0.6	0.7	0.6	ns
% SS	24.6	24.7	24.6	24.8	24.8	ns
pH	3.38	3.36	3.36	3.36	3.40	ns
TA	9.53	9.47	8.97	9.01	9.20	ns

4-LR: 4-basal leaves/shoots removed at trace bloom.

SO-1: Stylet Oil sprayed at trace bloom at 2%, 50gal/acre.

SO-2: Stylet Oil sprayed as SO-1 and 3-days later.

SO-3: Stylet Oil sprayed as SO-2 and 4-days later.

**Table 2-2005.** Mean Response of Clusters on Three Modal Shoots Selected for Detail Measurement.

Measurements	Treatments					F
	Control	4-LR	SO-1	SO-2	SO-3	
Florets/Cluster	243	277	248	221	251	ns
Mean Cluster Wt (g)	128a	78b	121ab	134a	121a	*
Berries/Cluster	83a	56b	88a	74a	77a	**
% Fruit Set	36.3b	22.4a	36.1b	40.1b	32.5b	**
Berry Weight (g)	1.5	1.4	1.4	1.6	1.5	ns
Rachis Length (mm)	111	96	107	101	107	ns
Compactness Index (berries/cm rachis)	6.9a	5.6b	8.0a	7.6ab	7.3ab	*
% Botrytis (w/w)	3.1a	0.4b	1.3ab	2.6a	1.7ab	*
% SS	24.6	24.7	24.6	24.8	24.8	ns
pH	3.38	3.36	3.36	3.36	3.40	ns
TA	9.5	9.5	9.0	9.0	9.2	ns

4-LR: 4-basal leaves/shoots removed at trace bloom.

SO-1: Stylet Oil sprayed at trace bloom at 2%, 50gal/acre.

SO-2: Stylet Oil sprayed as SO-1 and 3-days later.

SO-3: Stylet Oil sprayed as SO-2 and 4-days later.

**Table 3-2005.** Response of Pinot gris Grapevines to Different Levels of Leaf Removal at Trace Bloom.

Measurements	Treatments			
	Control	4-LR	6-LR	F
Initial Vine Size (kg)	0.80	0.91	0.91	ns
Shoots Retained	45	45	45	ns
Yield (kg/vine)	6.97	5.53	6.23	ns
Yield (T/A)	4.65	3.69	4.16	ns
Cluster #/vine	68	65	72	ns
Cluster Weight (g)	115	111	99	ns
Cluster/Shoot	1.5	1.4	1.6	ns
Berry Weight (g)	1.5	1.5	1.4	ns
Berries/Cluster	79	75	70	ns
% SS	21.6	21.7	21.8	ns
pH	3.75	3.81	3.81	ns
TA	4.8	4.8	4.6	ns

**Table 4-2005.** Mean Response of Three Modal Shoots/Treatments Vine Selected for Detailed Measurement, Pinot gris.

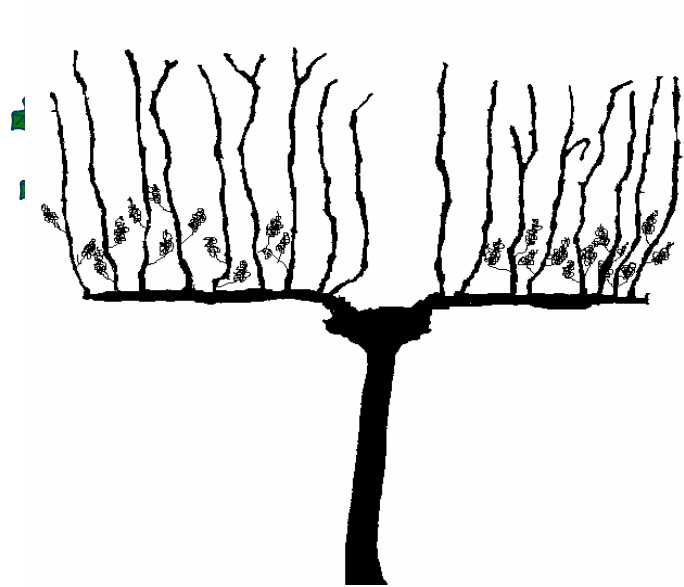
Measurements	Treatments			
	Control	4-LR	6-LR	F
Florets/Cluster	112	138	161	ns
Cluster Weight (g)	102a	85b	86b	**
Berries/Cluster	79	75	70	ns
% Fruit Set	59a	47ab	41b	*
Rachis Length (mm)	91	91	86	ns
Compactness Index (berries/cm rachis)	8.5	8.2	8.2	ns
% Botrytis (w/w)	3.5	3.0	1.2	ns
% SS	21.6	21.7	21.8	ns
pH	3.75	3.81	3.81	ns
TA	4.8	4.8	4.6	ns

**Table 5.** Response of Pinot noir Grapevines to Different Levels of Leaf Removal at Trace Bloom, 2005.

Measurements	Treatments			
	Control	4-LR	6-LR	F
Initial Vine Size (kg)	2.0	1.9	2.2	ns
Yield (lbs/vine)	11.03	7.06	9.60	ns
Yield (T/A)	3.34	2.14	2.91	ns
Cluster #/vine	63	49	53	ns
Cluster Weight (g)	117a	101b	106ab	*
Cluster/Shoot	1.4	1.1	1.2	ns
Berry Weight (g)	1.4	1.4	1.4	ns
Berries/Cluster	84	77	80	ns
% SS	22.7	23.3	23.2	ns
pH	3.77	3.84	3.87	ns
TA	5.49a	4.84b	4.79b	**

**Table 6.** Mean Response of Three Modal Shoots/Treatments Vine Selected for Detailed Measurement, Pinot noir 2005.

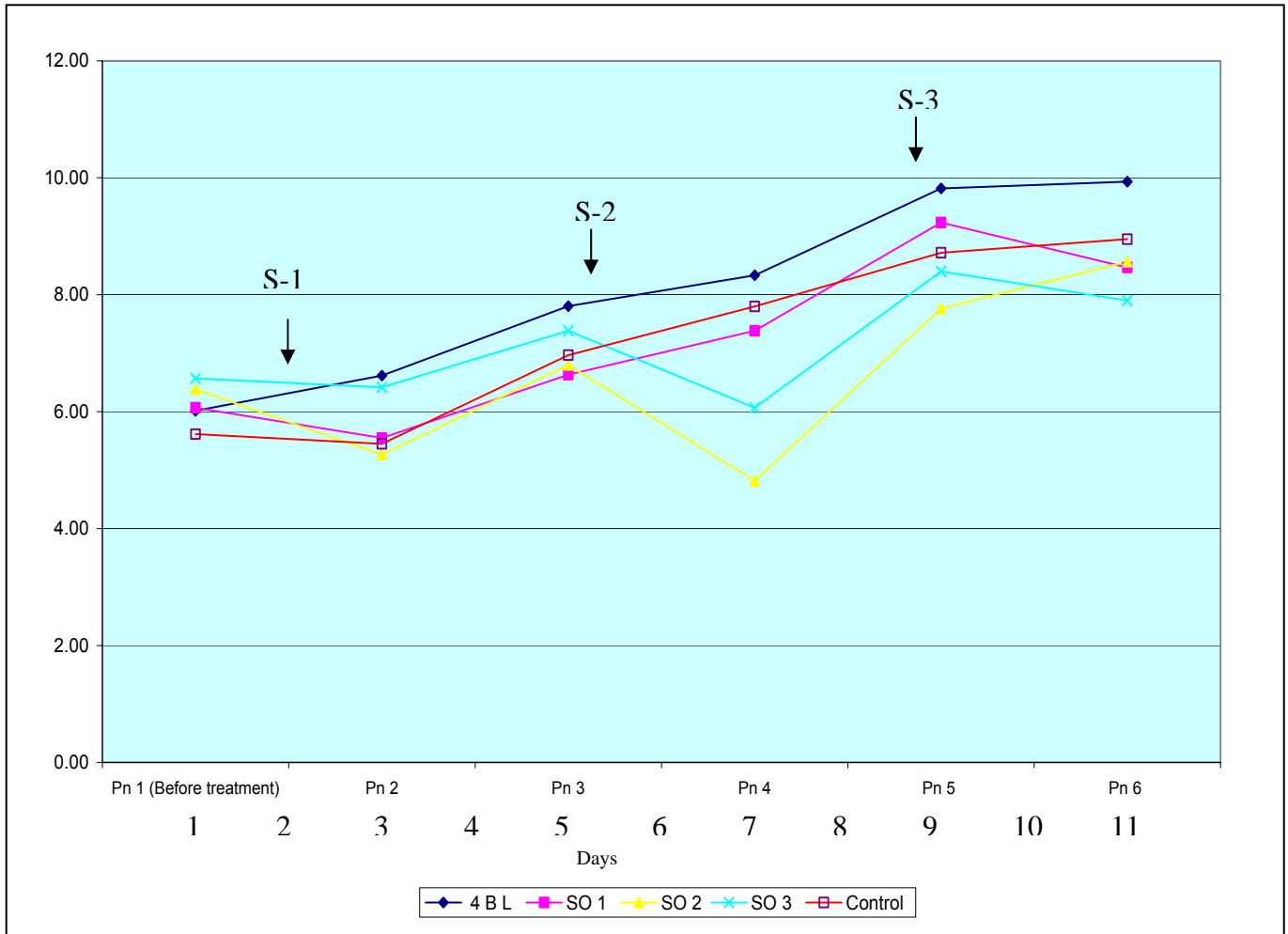
Measurements	Treatments			
	Control	4-LR	6-LR	F
Florets/Cluster	196	189	199	ns
Cluster Weight (g)	117a	101b	106ab	*
Berries/Cluster	84	77	80	ns
% Fruit Set	47	45	47	ns
Rachis Length (mm)	102	96	98	ns
Compactness Index (berries/cm rachis)	7.5	7.6	7.1	ns
% Botrytis (w/w)	11.2	7.4	7.5	ns
% SS	22.7	23.3	23.2	ns
pH	3.77	3.84	3.87	ns
TA	5.49a	4.84b	4.79b	**



**Figure 1.** An example of a method proposal for evaluation to ameliorate negative Year-2 responses.



**Figure 2.** Visual expression of within cluster compactness differences.



**Figure 3.** Influence of Leaf Removal and One, Two, or Three Applications of 2% Stylet Oil at a Rate of 50 gal/acre. Spray 1 on day 2 (Trace Bloom), Spray 2 on day 4 and Spray 3 on day 5. Data points are dates of Pn Measurement of Leaf Node Position Five from the Base of the Shoot.