Irrigation Management – Fine-tuning Rates and Frequencies for Fruit and Wine Quality and Vine Hardiness

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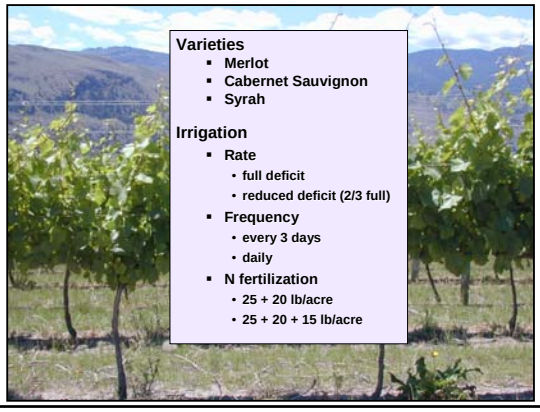
Irrigation and N Management



Varieties
- Merlot
- Cabernet Sauvignon
- Syrah

Irrigation
- Rate
  - full deficit
  - reduced deficit (2/3 full)
- Frequency
  - every 3 days
  - daily
- N fertilization
  - 25 + 20 lb/acre
  - 25 + 20 + 15 lb/acre

Summary

Performance	Deficit irrigation	Daily irrigation
Water use efficiency	increased	increased
Soluble solids (brix)	increased	increased
Juice pH	increased	reduced
Juice TA	reduced	increased
Anthocyanins	increased	increased
Skin tannins	no effect	increased
Seed tannins	no effect	increased

Desired effect
Undesired effect

Merlot Wine Sensory Quality

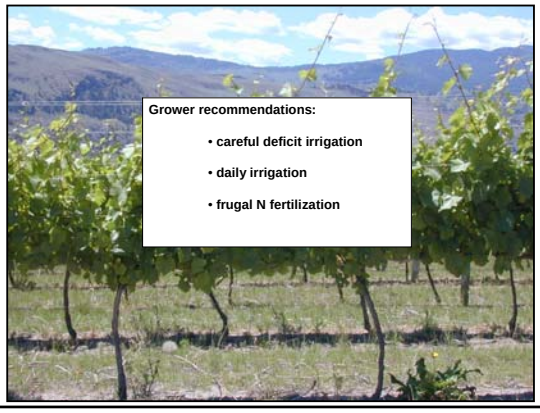
- 4 treatments x 4 blocks evaluated
  - daily irrigation, 45 lb/acre N
  - daily irrigation, 45 + 15 lb/acre N
  - irrig every 3 days, 45 lb/acre N
  - irrig every 3 days, 45 + 15 lb/acre N
- 12 judges blindly tasted the 16 wines twice
- Ratings for:
  - Body
  - Astringency
  - Length of aftertaste (longevity on palate)
  - Aromas and flavours
    - black fruit
    - red fruit
    - cooked fruit
    - herbaceous
    - spicy
    - floral (aroma only)
    - colour intensity

Merlot Wine Sensory Quality

Wine sensory trait		Daily irrigation	Extra N fertilizer
Body		increased 2009 and 2010	reduced 2010
Length on palate		increased 2009	reduced 2010
Colour intensity and darkness		increased 2009 and 2010	reduced 2010
Aroma	Red fruit	increased 2009	no effect
	Black fruit	increased 2009	no effect
	Herbaceous	reduced 2009	no effect
Flavour	Red fruit	increased 2009	reduced 2010
	Black fruit	increased 2009	reduced 2010
	Cooked fruit	increased 2009	no effect
	Spicy	increased 2009	no effect
	Herbaceous	reduced 2009	no effect

Desired effect
Undesired effect

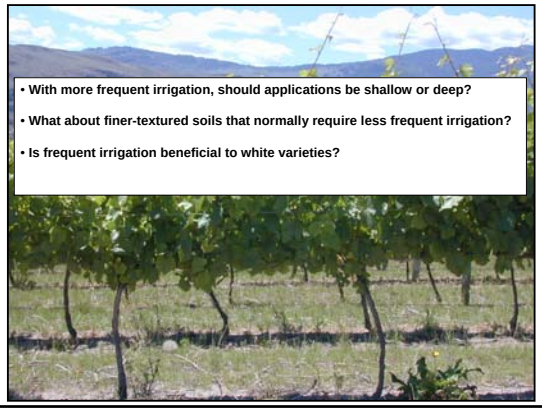
Irrigation Regimes and N Fertilization



Grower recommendations:

- careful deficit irrigation
- daily irrigation
- frugal N fertilization

Irrigation Regimes – Frequency, Rate and Spatial Distribution



- With more frequent irrigation, should applications be shallow or deep?
- What about finer-textured soils that normally require less frequent irrigation?
- Is frequent irrigation beneficial to white varieties?

Irrigation Regimes – Frequency, Rate and Distribution

Merlot on loamy sand

Pinot gris on sandy loam

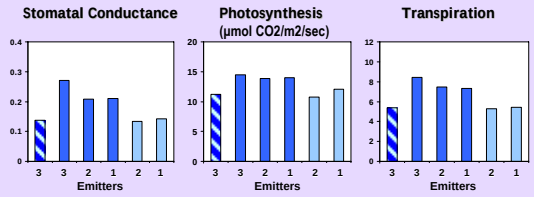
DIAP Irrigation Regimes – Frequency, Rate and Distribution

Merlot on Loamy Sand

Irrigation

- **Rate**
  - full (deficit) – 8 L/day
  - reduced – 5.3 L/day
- **Frequency**
  - every 3 days
  - daily
- **Emitter density**
  - 1 emitter/vine
  - 2 emitters/vine
  - 3 emitters/vine
- **Durations** – 1.33 to 4 hours

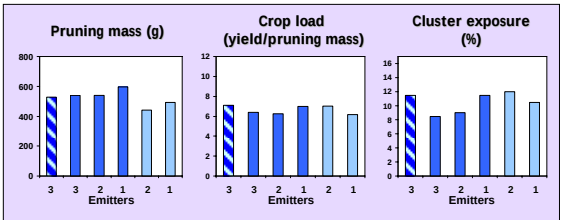
Leaf Gas Exchange



Stomatal conductance and gas exchange increased by:
- more water
- daily irrigation
- shorter/shallower applications

WUE improved by longer/deeper daily irrigations

Vigour and Crop Load

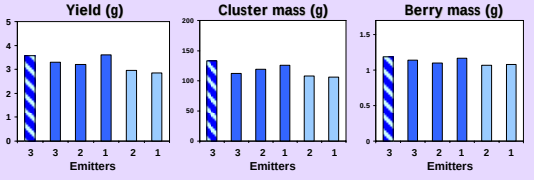


Vigour increased by:
- more water
- daily irrigation

Crop load was unaffected

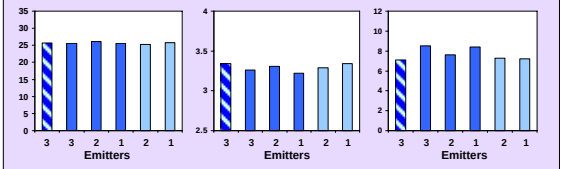
Exposure increased by:
- less water
- 3-day irrigation
- deeper/longer irrigations

Yield Components



Yield and berry mass increased by:
- more water applied
- deeper/longer irrigations

Berry Composition

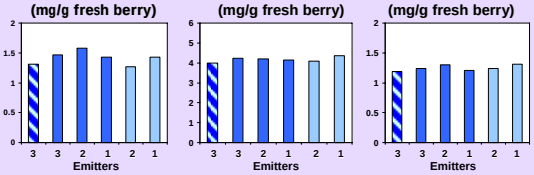


Soluble solids increased slightly by:
- more water

Juice pH reduced by:
- more water
- daily irrigation

Juice TA increased by:
- more water
- daily irrigation

Phenolics



Skin tannin increased by:
- more water & daily irrigation

Seed tannin was unaffected

Anthocyanin increased slightly by:
- less water

Summary - Merlot

Performance	Reduced-deficit irrigation	Daily irrigation	Fewer emitters, deeper/longer irrigations
Yield	reduced	no effect	increased
Water use efficiency	increased	increased	increased
Soluble solids (Brix)	reduced	no effect	no effect
Juice pH	increased	reduced	no effect
Juice TA	reduced	increased	no effect
Anthocyanins	increased slightly	no effect	no effect
Skin tannins	reduced	increased	no effect
Seed tannins	no effect	no effect	no effect

Desired effect
Undesired effect

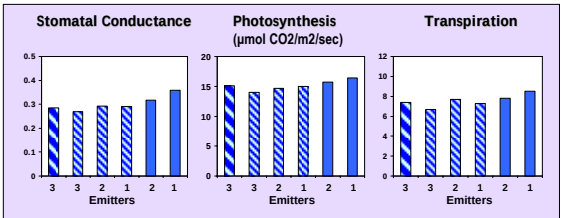
DIAP Irrigation Regimes – Frequency, Rate and Distribution

Pinot gris

Irrigation

- Rate – 3 L/day
- Frequency
  - 8 days
  - 2 days
  - daily
- Emitter density
  - 1 emitter/vine
  - 2 emitters/vine
  - 3 emitters/vine
- Durations – 0.75 to 4 hours

Leaf Gas Exchange

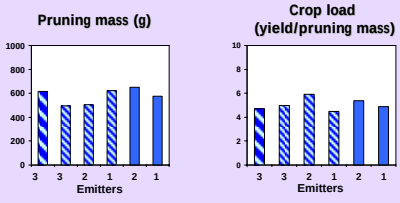


8 days
2 days
daily

Stomatal conductance and gas exchange increased by
- more frequent irrigation
- longer/deeper irrigations

WUE was unaffected

Vigour and Crop Load

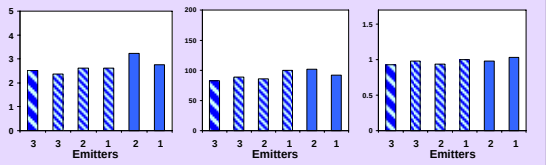


Vigour was unaffected

Crop load was little affected

8 days
2 days
daily

Yield Components – Pinot gris

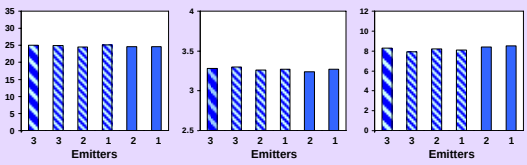


Yield and berry mass increased slightly by:

- more frequent irrigation

8 days
2 days
daily

Berry Composition



Basic juice composition was little affected

8 days
2 days
daily

Summary – Pinot Gris

Performance	Frequent irrigation	Fewer emitters, deeper/longer irrigations
Vigour	no effect	no effect
Yield	increased slightly	no effect
Water use efficiency	no effect	no effect
Soluble solids (Brix)	no effect	no effect
Juice pH	no effect	no effect
Juice TA	no effect	no effect

Pinto Gris Wine Sensory Quality

- 4 treatments x 3 blocks evaluated
  - daily, 1 emitter/vine, 1.5 hr
  - every 2 days, 1 emitter/vine, 3 hr
  - every 2 days, 3 emitters/vine, 1 hr
  - every 8 days, 3 emitters/vine, 4 hr
- 12 judges blindly tasted the 12 wines twice
- Ratings for:
  - Body
  - Aromas and flavours
    - fruity
    - vegetative

Pinot Gris Wine Sensory Quality

Wine sensory trait		More frequent irrigations	Fewer emitters, longer irrigations
Body		increased	no effect
Aroma	Fruity	no effect	no effect
	Vegetative	no effect	no effect
Flavour	Fruity	increased	no effect
	Vegetative	no effect	no effect

Frequent irrigation (every 1-2 days) improved wine sensory quality

Influence of Irrigation Regimes and ABA on Bud Hardiness

ABA appears to improve plant tissue hardening and hardiness

Two studies:

- Effects of irrigation regimes on bud hardiness:
  - initiated in winter 2011/2012
- Influence of post-harvest ABA sprays on hardiness:
  - natural ABA
  - long-lived analog
  - mixture

Acknowledgements:

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