

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

**DIAP Activity 7: Manipulating Grape and Wine Vegetative Aromas through Vineyard Management Practices**

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## Methoxy pyrazines

**Wine Aroma Wheel**

isobutylmethoxypyrazine    isopropylmethoxypyrazine    secbutylmethoxypyrazine

**Common pyrazines**

- Isobutylmethoxypyrazine (IBMP)
  - fresh bell pepper
- Isopropylmethoxypyrazine (IPMP)
  - green peas
- Secbutylmethoxypyrazine (SBMP)
  - beetroot

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### Common in Nature

Ladybug taint is a pyrazine which is also produced by grapes

2-isopropyl-3-methoxypyrazine (IPMP), produced by *Harmonia axyridis* Pallas (Multicolored Asian Lady Beetle - MALB)

isopropylmethoxypyrazine

### Grape Pyrazines

- Pyrazines can be detected by taste in the vineyard (herbaceous).

- Herbaceous and bell pepper characteristics, as well as earthy aromas.

- IBMP and IPMP have very low sensory detection thresholds (1 to 2 ng/L in white wines and 10 – 15 ng/L in red wines).

- Minute quantities represent significant aromatic and flavour characteristics in wine.

### Pyrazine distribution in clusters and grapes

**Figure 2** Distribution (in %) of IBMP in the various parts of Cabernet Sauvignon grape bunches and grapes during ripening in 1999.

Stage	stem	skin	seed	flesh
Before veraison (Aug 4)	79.2	14.8	5.3	0.9
After veraison (Aug 27)	87.4	9.4	2.9	0.2
Harvest	53	44.1	1.9	0.2

**Figure 3** Distribution (in %) of IBMP in the various parts of Cabernet Sauvignon grape during ripening in 1999.

Stage	stem	skin	seed	flesh
Before veraison (Aug 4)	72	23.8	4.3	0.2
After veraison (Aug 27)	52.7	4.2	0.7	0.2
Harvest	35.5	4.1	0.4	0.2

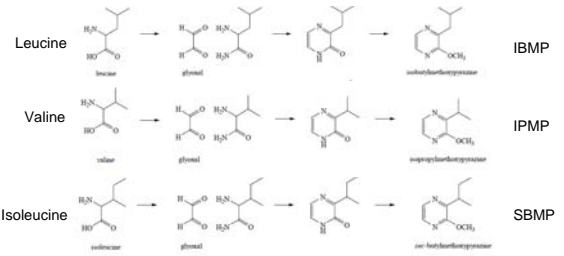
Roujou de Boubee et al.  
Am. J. Enol. Vitic. 53:1 (2002)

### Pyrazines are Well Studied

1. **Temperature** - Pyrazine decrease following veraison is correlated to the decrease in malic acid concentration. Increased sun exposure increases the rate of grape maturation and the reduction in methoxypyrazines.
2. **Light exposure** - Correlated to vegetative character. Experiments indicate a direct role of light in synthesis and degradation of pyrazine.
3. **Vigour** - High soil moisture and vine vigour delays fruit maturation and the reduction of methoxypyrazines.
4. **Crop load** - Minimal or excessive crop to leaf area can delay the rate of fruit development and the breakdown of methoxypyrazines.
5. **Uneven ripening** - Pyrazines are in higher concentrations in unripe fruit. This stems from both unripe grape tissue and seeds. Immature seeds contain extractable pyrazines.
6. **Varieties and clones** - Prevalence of Pyrazines

## Manipulating Grape and Wine Vegetative Aromas Through Vineyard Management Practices

### Alpha amino acid



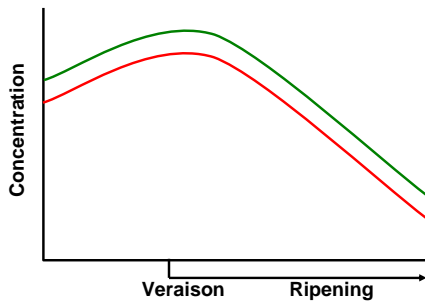
### Alkylmethoxypyrazine

## Pyrazines are Well Studied

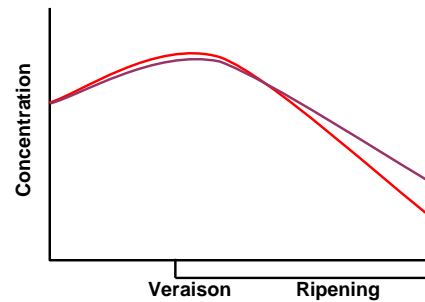
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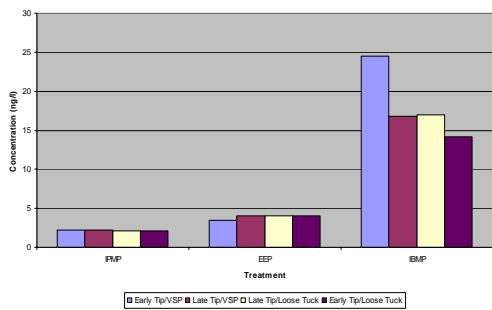
### Methoxypyrazines



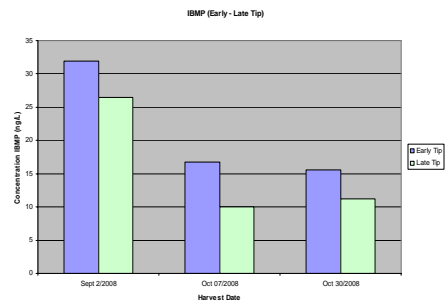
### Methoxypyrazines



### Cabernet Sauvignon pyrazines at harvest



### Merlot IBMP development



## 7. Manipulating vegetative aromas through vineyard management

Nitrogen application rate and frequency effects on fruit/wine pyrazine content

**Experiment:** McIntire Vineyard (Oliver)

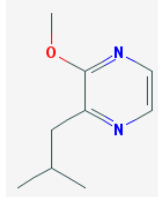
- Cabernet Sauvignon
- Sauvignon Blanc

**Nitrogen treatments:**

- Frequency: bud break, berry set, veraison
- Rate: Cab: 56, 84, 112 kg N/ha  
Sauv. Blanc 36, 54, 72 kg N/ha

**Measurements:**

- leaf and fruit nitrogen
- canopy dimensions (e.g. density, size, fruit exposure)
- development of berry composition from pea size to maturity – basic and pyrazines
- wine quality (micro lots) – basic composition and pyrazines



## Nitrogen application rates and frequency

Cabernet Sauvignon

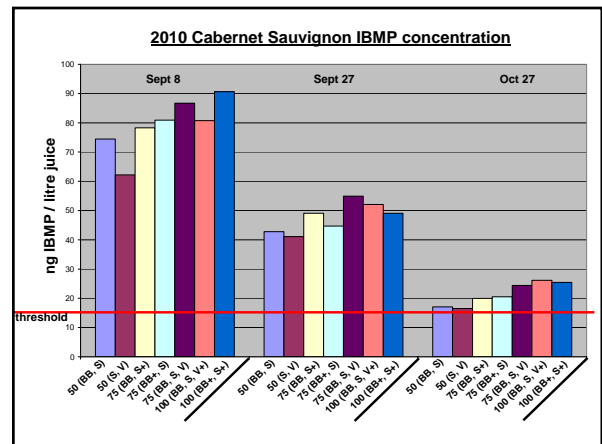
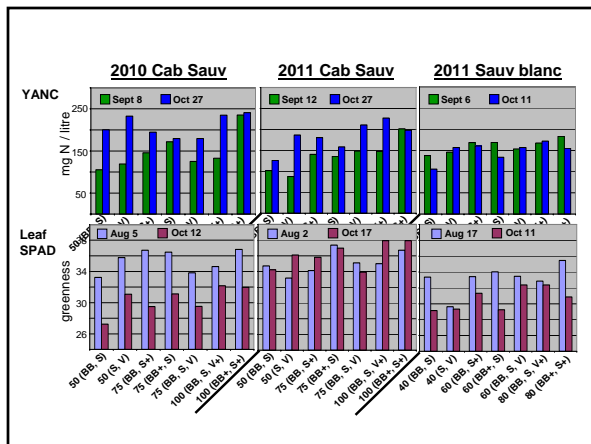
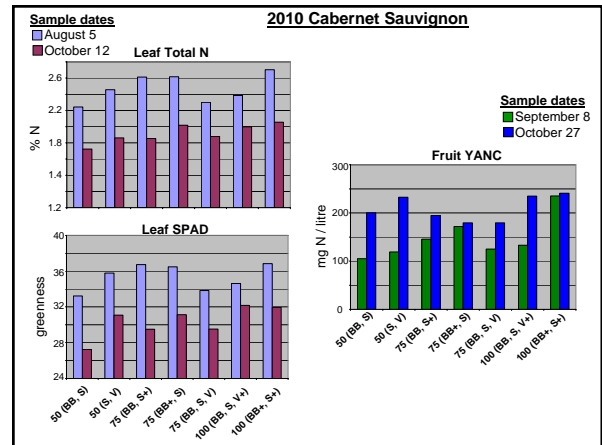
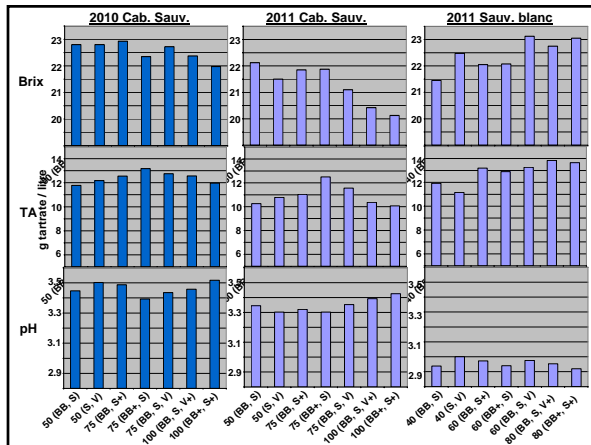
Sauvignon blanc

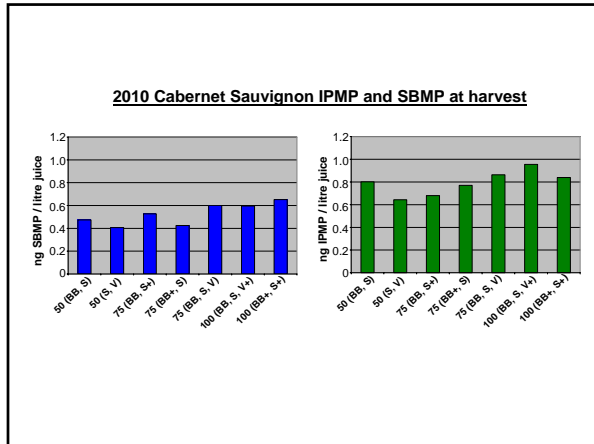
	Bud Break	Set	Veraison	Total
50 (BB, S)	25	25	0	50
50 (S, V)	0	25	25	50
75 (BB, S+)	25	50	0	75
75 (BB+, S)	50	25	0	75
75 (BB, S, V)	25	25	25	75
100 (BB, S, V+)	25	25	50	100
100 (BB+, S+)	50	50	0	100

	Bud Break	Set	Veraison	Total
50 (BB, S)	20	20	0	40
50 (S, V)	0	20	20	40
75 (BB, S+)	20	40	0	60
75 (BB+, S)	40	20	0	60
75 (BB, S, V)	20	20	20	60
100 (BB, S, V+)	20	20	40	80
100 (BB+, S+)	40	40	0	80

•Nitrogen was applied as 34-0-0

•Application rates are lbs/acre





## Thank you

**Acknowledgements:**

- Cooperating vineyards
- BC Wine Grape Council
- Excellent technical team
- AAFC DIAP program

Canada