# Berry Shrivel Research Update

Sonoma County Grape Day

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# Terms in literature for a rachis disorder

- Waterberry (California)
- Bunch stem necrosis – BSN (Australia)
- Stiellähme (Germany)
- Shanking (New Zealand)
- Desséchement de la rafle (France)
- Disseccamento del rachide (Italy)
- Palo Negro (Chile)

# Waterberry

"The first symptom is the appearance of a very striking, brownish-black spot about a millimeter in diameter in the pedicel adjacent to the tapering end of the torus."

Kasimatis 1957

# Berry Shrivel

“The first symptoms of berry shrivel appear when individual berries begin to lose their turgidity about a month prior to harvest. Additionally, some fail to develop the characteristic red color.”

Jensen 1970

# Associated with waterberry and bunch stem necrosis:

- Crop load
- Nutritional imbalances
- Hormonal imbalances
- Weather
- Water relations
- Elevated putrescine
- Annual variability of expression

# 2002 Study

Lab analyses funded by UC Division of Ag and Natural Resources Analytical Lab

- 3 sites: «**O**akville **E**xperimental **V**ineyard
  «**A**lexander **V**alley
  «Rutherford
- One cluster sampled per vine at veraison and then at 2-week intervals
- When a vine showed berry shrivel, both a symptomatic and normal cluster were sampled per vine.

# 2003 Study

Supported by the American Vineyard Foundation

- 3 sites: «**O**akville **E**xperimental **V**ineyard
  «**A**lexander **V**alley
  «Rutherford
- One cluster sampled per vine at veraison, onset of symptoms and harvest
- At onset and harvest, both a symptomatic and normal cluster were sampled per vine

# Two types of vines and two types of clusters

- A non-symptomatic vine = a “Good” vine
- A symptomatic vine = a “Bad” vine
- A Bad vine has 2 cluster types:
  - “Good Clusters” – these are normal looking clusters
  - “Bad Clusters” – these clusters have berry shrivel

# Two clusters types on a symptomatic vine

## Comparing 2 vine types

**<u>Prior to the onset</u> of visual symptoms, the chemistry is different in clusters on bad vines compared to clusters on good vines**

<u>BRIX</u>

- 2002: **Always** lower in bad vines prior to onset of symptoms at OEV. Not lower prior to onset of symptoms at Alexander Valley.
- 2003: Lower in bad vines at veraison in OEV. Not lower at veraison in Alexander Valley.

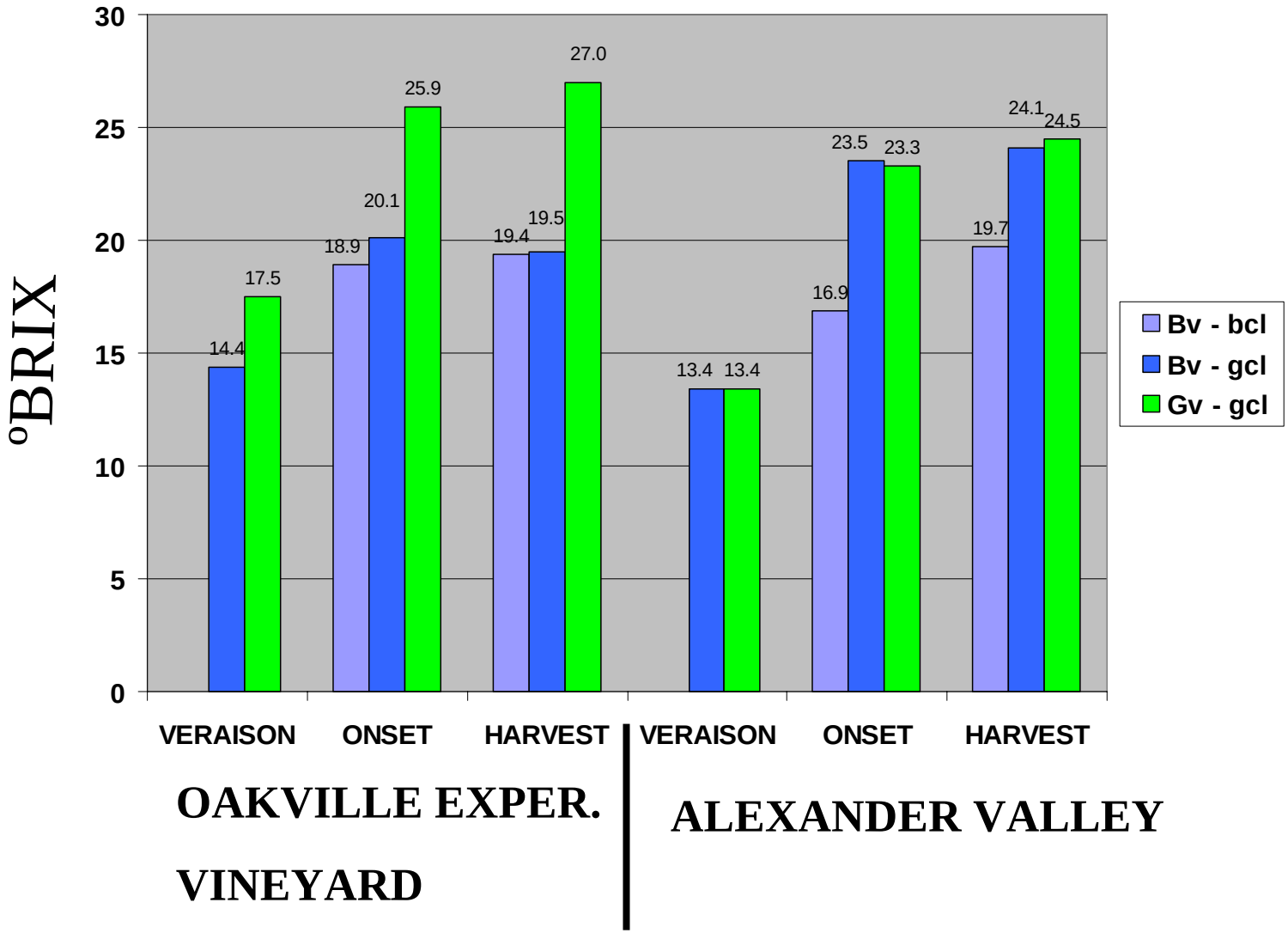
## Comparing 2 vine types

**From onset of symptoms through harvest, chemistry is different in both types of clusters on bad vines compared to clusters on good vines**

BRIX

- 2002: Bad Vines had lower Brix at onset (which was near harvest) in OEV. Lower in Brix from onset through harvest at AV.
- 2003: Bad Vines had lower Brix at onset and harvest in OEV. No difference in Brix between two different vine types at AV.

# Juice from clusters sampled at three times in each vineyard, 2003



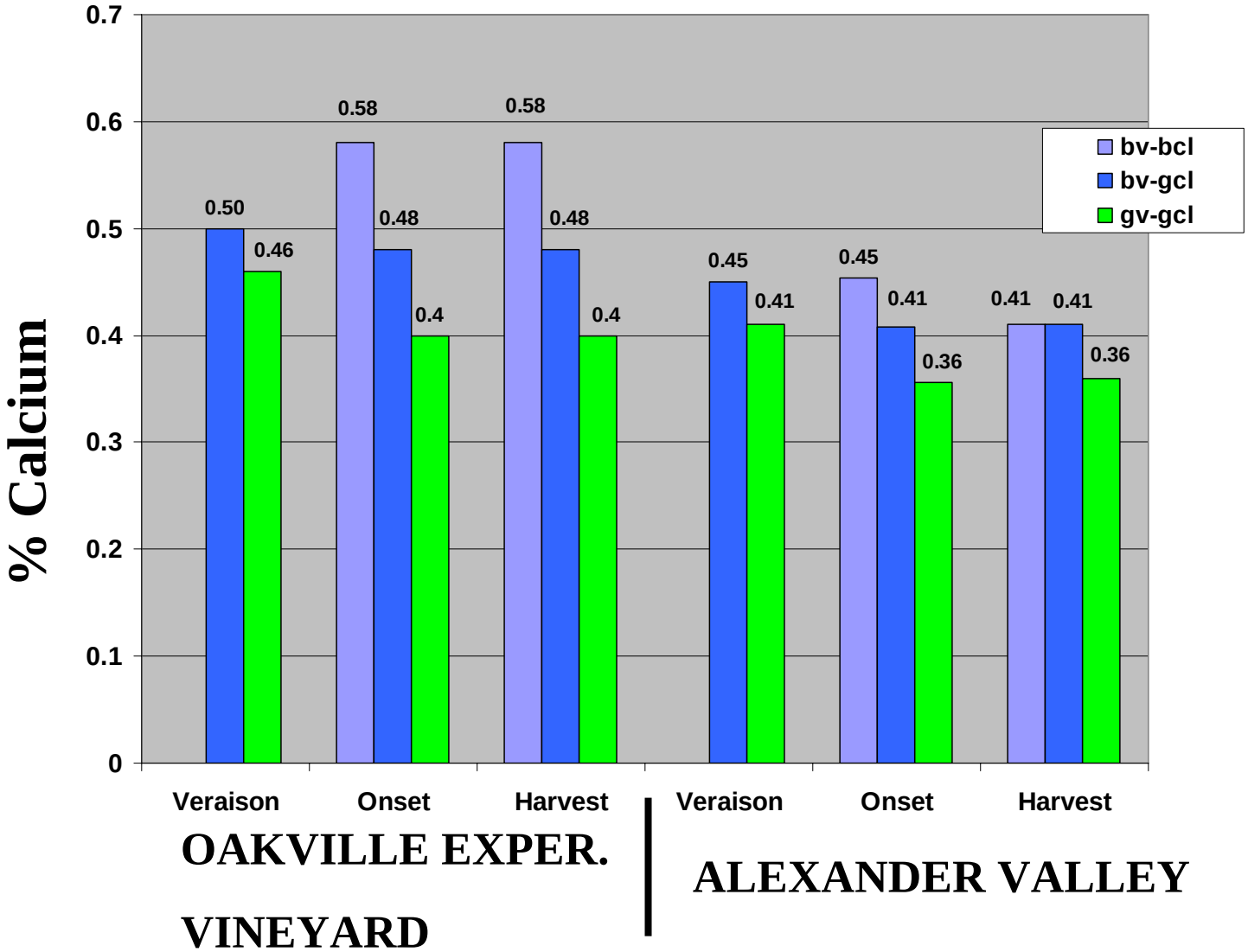
## Comparing 2 vine types

**From <u>onset of symptoms through harvest</u>, chemistry is different in both types of clusters on bad vines compared to clusters on good vines**

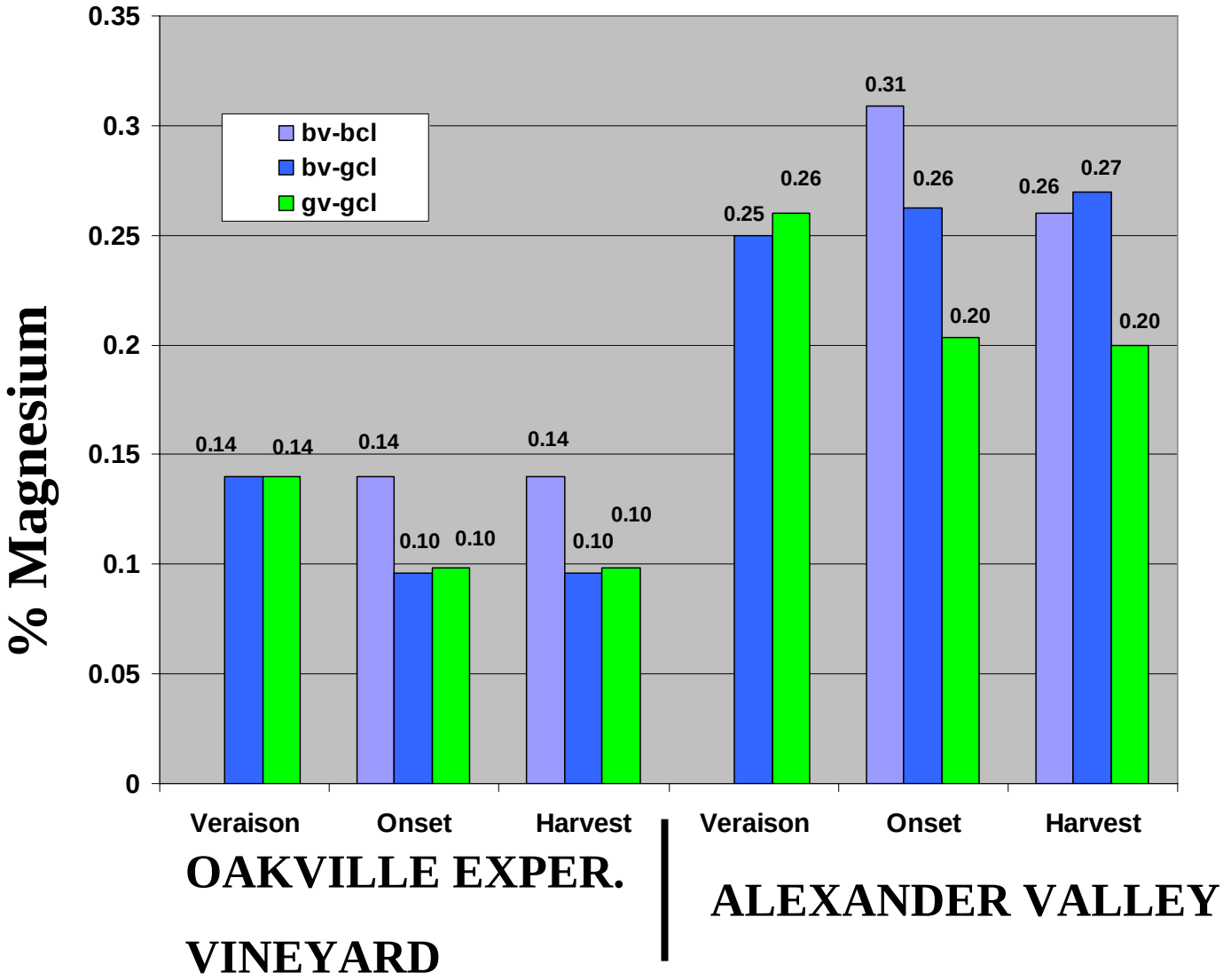
<u>Calcium and Magnesium</u>

- 2002: rachis tissue from clusters on bad vines was **always significantly** higher in Ca and Mg than in rachises on good vines in both sites.
- 2003: rachis tissue from clusters on bad vines **tended** to be higher in Ca and Mg than in rachises on good vines in both sites.

# Percent calcium in rachis tissue from clusters sampled at three times in 2002



# Percent magnesium in rachis tissue from clusters sampled at three times in 2002



# Cluster Rachis Analysis, 1980 Waterberry Survey

| | TOTAL N (%) | NH4-N (ppm) | K (%) | Ca (%) | Mg (%) | Ratio K/(Ca+Mg) |
|---|---|---|---|---|---|---|
| **Low Incidence Areas: Normal Clusters** | 1.27 c | 1498 c | 2.15 a | 1.09 a | 0.34 a | 1.50 a |
| **High Incidence Areas: Normal Clusters** | 1.85 b | 2581 b | 2.10 a | 0.90 a | 0.28 a | 1.78 a |
| **High Incidence Areas: Symptom clusters** | 2.50 a | 4627 a | 1.33 b | 0.93 a | 0.28 a | 1.10 b |

Christensen & Boggero 1985

Ca and Mg not different in normal or symptom cluster rachises

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Gv-gc

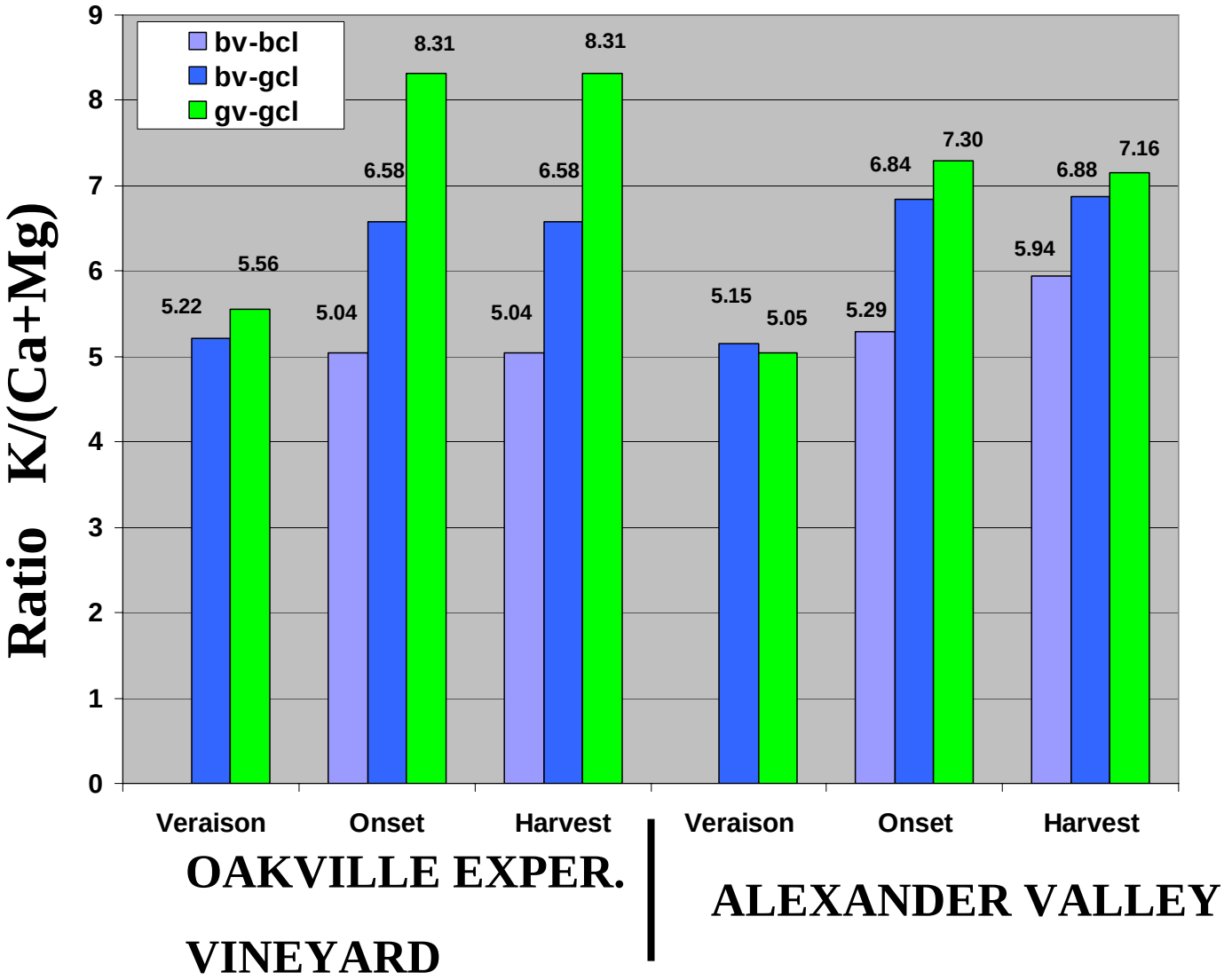
Bv-gc

Bv-bc

Christensen & Boggero 1985

# Lower ratio in Bad vines

## Ratio of K/(Ca+Mg) in rachis tissue from clusters sampled at three times in 2002



**Ratio of K/(Ca+Mg) was less in symptom cluster rachises**

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Christensen & Boggero 1985

# Ratios in rachis tissue of Bad clusters

**K/(Ca + Mg) = LOW RATIO = HIGH *BS***

NORTH COAST 2002 and 2003 SURVEY (2 SITES)

**K/(Ca + Mg) = LOW RATIO = HIGH WB**

Christensen & Boggero 1985

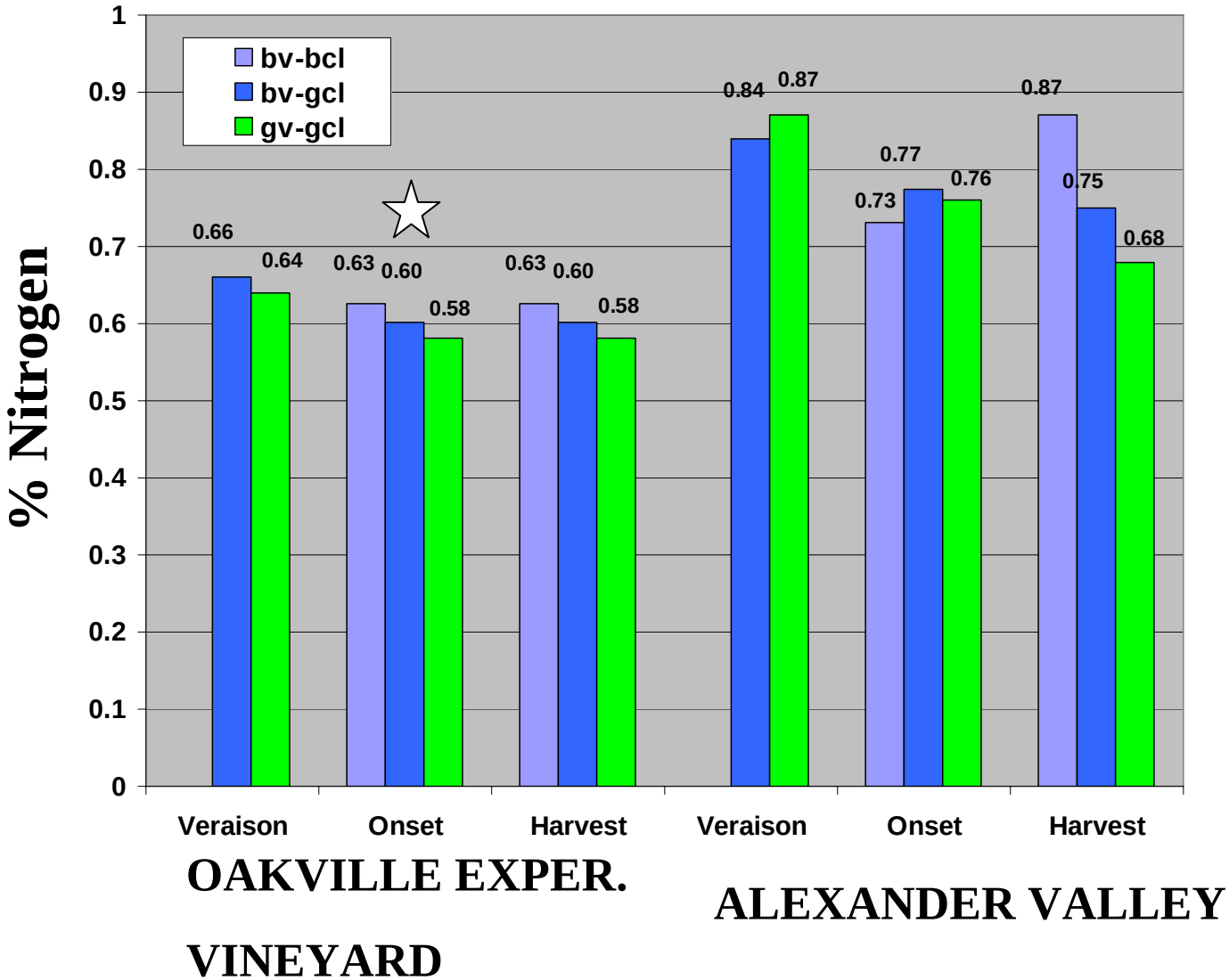
**K/(Ca + Mg) = HIGH RATIO = HIGH BSN**

Holzpfel & Coombe 1996

**K/(Ca + Mg) = HIGH RATIO = LOW BSN**

Capps & Wolf 2000

# Percent Nitrogen in rachis tissue from clusters sampled at three times in 2002



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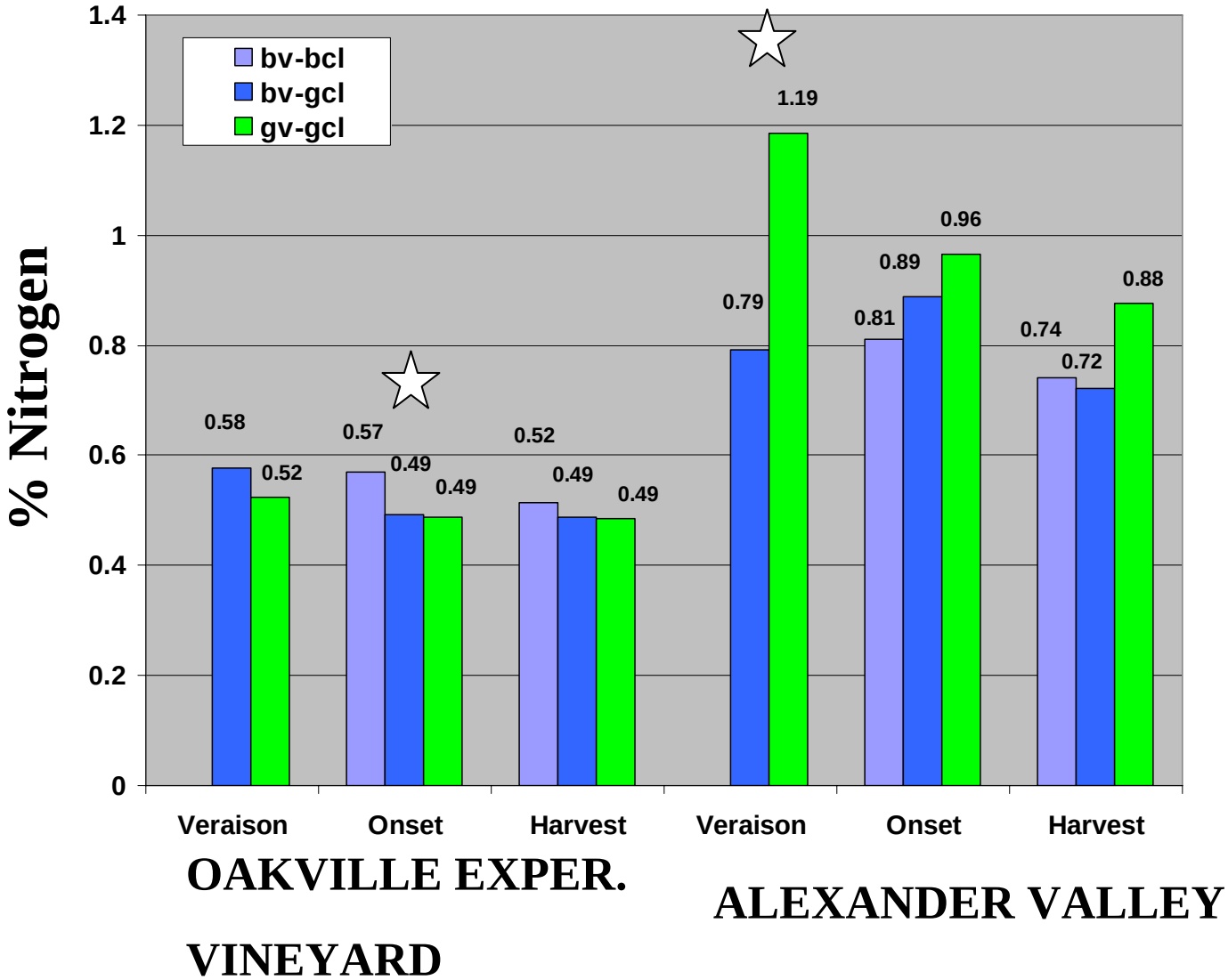

Nitrogen

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Christensen & Boggero 1985

# Take home message from rachis analyses:

Berry shrivel does not appear to be identical to waterberry / BSN, but there is no doubt a link between the two types of disorders.

# UC biochemist Doug Adams determined that the mesocarp from symptom berries had only half of the cell wall material than found in non-symptom fruit.

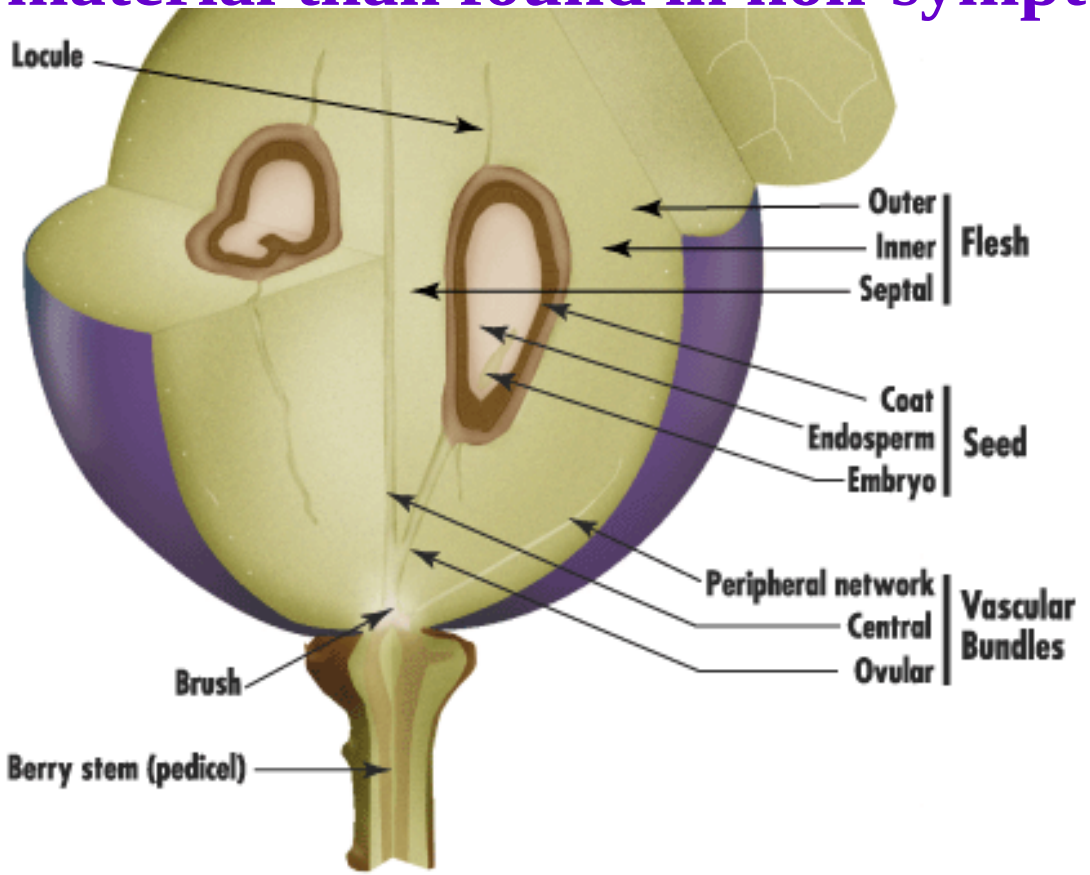


Figure I: Structure of a ripe grape berry partially sectioned on the long and central axis to show internal parts. Illustration by Jordan Koutroumanidis, Winetitles.

# Symptoms include low sugar and shriveled fruit….

Is the xylem “hanging in there” longer than normal?

- Test for xylem transport using dye solutions on excised pedicles
- Test for xylem integrity
- Test the ability of the xylem to give up water back to the parent plant

# Symptoms include low sugar and shriveled fruit….

Is the phloem functioning normally?

➡ Analyze phloem transport from leaves to berries

# Symptoms include low sugar and shriveled fruit….

Do hot spells play a role?

- Collect fruit prior to and during a hot period and analyze fruit composition.
- Create different canopy conditions to test effect of high temperatures and evaporative demand.

# Symptoms include low sugar and shriveled fruit….

Is the lower amount of cell wall material in bad clusters due to cell wall degradation or did cell wall material fail to develop?

➡ Measure the amount of cell wall material periodically during ripening.

# Juice from single clusters at veraison, Oakville 2003