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# Phenology and Growth of Grapevines

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**Soil**

- Depth
- Texture
- Water and nutrient supply


**Climate**

- Radiation
- Temperature
- Humidity
- Windspeed
- Rainfall
- Evaporation

**Cultural decisions**

- Vine density
- Scion and rootstocks
- Fertilization
- Irrigation
- Pest Control
- Pruning levels
- Soil/Site Management

Vine Performance



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# Phenology

- the study of the events or growth stages that recur seasonally and relative to climatic factors ( day length, temperature, solar radiation, etc)



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## How does a vine grow

- Growth is indeterminate
- Can grow wood or fruit
- Fruit bud initiation occurs in season **previous** to year of fruiting
- Fruit bud initiation dependent on sunlight



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## Growth is indeterminate



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## Wood or Fruit



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## Growing Degree days

- growing degree days GDD
- $GDD = [(T_{max} + T_{min}) / 2] - \text{Threshold } T$

where threshold T for grapes is 50 F



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## Growth

- “ an irreversible increase in the size of the plant “ ( Mullins 1992)
- An increase in the size of cells already present
- An increase in the number of cells by divisions with meristems ( growing points)



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## Annual growth cycle

- Longer than a single 12 month period when looking from initiation of events until expression
- Need for accurate communication of developmental stages



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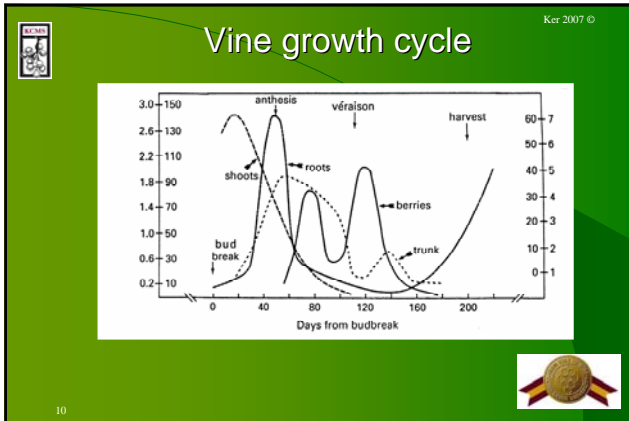
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- ## Components of a Good Descriptive System
- Contains a succession of developmental events that follow each other
  - Contains easily recognizable, identifiable and adequately described stages
  - Uses consistent stages for assessment
  - Where possible incorporates quantifying measurements to increase precision
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- ## Beginning and End of Dormancy
- EL stages 01 and 47
  - Initial stages begin prior to harvest
- 12

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## Dormancy Initiation

- Photoperiod decreases
- Mean daily temperature decreases
- Hormonal response
  - Gibberellic acid ↑
  - Auxins (IAA) ↓
  - Cytokinins ↓
  - Dormins (abscisic acid) ↑



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## Dormancy types

- **Innate Dormancy** aka **Endodormancy**
  - Buds incapable of growth due to hormone levels
  - Can only be overcome by “chilling requirement”
- Chill unit = number of hours between 32 and 40 F
- For grapes in NE this requirement is met usually by Late December



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## Dormancy Types

- Once chilling requirement is met what limits growth?
  - Environmental factors – temperature, moisture, sunlight, ?????
- **Imposed Dormancy** or **Ectodormancy**



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## Budburst

- Winter bud
- Budswell
- Woolly bud
- Green Tip
- Rosette of leaf tips visible
- First leaf separated from the shoot tip



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## Budburst

- Occurs when endo and ecto dormancy factors satisfied
- ABA concentration ↓
- IBA, GA and cytokinins ↑
- Mean daily temp > 50 F\* (Australia study at 46 F)
- Day length > 12 hrs



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Dormant Bud  
(EL 01)



Bud Swell  
(EL 02)



Green Tip  
(EL 04)



Rosette  
(EL 05)



Bud growth  
01-05



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## Shoots 10 cm

- Goes from 2 to 3 leaves separated through to 14 leaves separated with flower caps in place, colour fading
- *Beginning of use of nutrients absorbed by roots in current spring*



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## Shoot growth

- Cell enlargement and cell division
- IAA allows for cell elasticity and expansion is due to water uptake
- Key items – sunlight and water!



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## Early Shoot Growth 12-17


10 cm Growth (EL 12)




Seven Leaves (EL 14)




Ten Leaves (EL 16)



Twelve Leaves (EL 17)





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## Flowering Begins

- 16 leaves separated, first caps loosen and fall
- 10% caps fallen
- 30 % caps fallen



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Fourteen Leaves –  
Immediate Prebloom  
(EL 18)



Caps Beginning to  
Dehisce  
(EL 19)

**Begin flowering**



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10 Percent  
Capfall (EL  
20)



Cap Falling,  
Stamens Visible

**Capfall**



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## Full Bloom – 50% Caps off

- 17 to 20 leaves separated, 50% of caps fallen
- 80% caps fallen
- Cap Fall complete



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80 Percent Caps Off  
(EL 25)



Fully Exposed  
Floret

Flowering late



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## The next Crop

- Formation of the winter bud
- Light > compensation point
- Light on the leaf and bud
- Mean daily temp >60 F
- No excessive rainfall????



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## Setting – Young Berries

- Setting young berries > 2 mm
- Berries peppercorn size approx 1/8 inch



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## Successful fruit set

- Adequate sunlight
- Temperature ( optimum pollen germination at 65 F)
- Dry but not arid conditions
- Can be hampered by
  - Temps 57 F or lower, or 85 F or higher
  - Rainy weather



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Fruit Set (EL 27)



Close Up of Set Fruit

Fruit set



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## Veraison

- Berry softening begins
- Berry colouring begins



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Beginning of  
Veraison



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## Veraison

- Berry color changes
- Berry accumulates water/sugar
- Berry accumulates flavorants
- Berry softens
  - Changes in cell wall composition



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## Stages of Veraison: Physiological

1. Sugar/Water accumulation via phloem alone
2. Arrest of xylem (water conducting tissue) transport to berry
3. Onset of dehydration
4. Raisining



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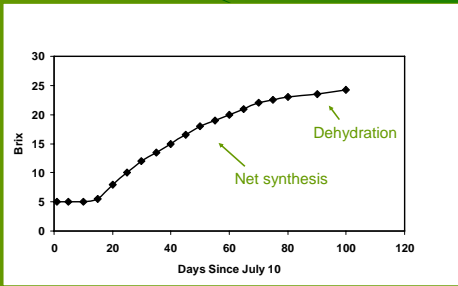
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## Berry Sugar Accumulation



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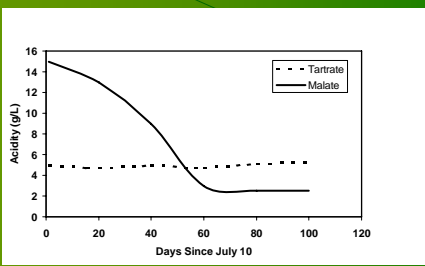
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## Changes in Berry Acidity



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## Harvest – Berries Ripe

- Berries harvest ripe
- Berries over-ripe
- Through to leaf fall



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Harvest



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## Assessment of Grape Maturity

*Berry Macrocomponents:*

- Sugar
- pH
- Acidity
- Balance of Sugar/Acidity
- Ratio of Malate to Tartrate



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## Assessment of Grape Maturity

**Berry Protein Content:**

- Total protein
- Protein profile
- Specific proteins
- Specific enzymatic activity level



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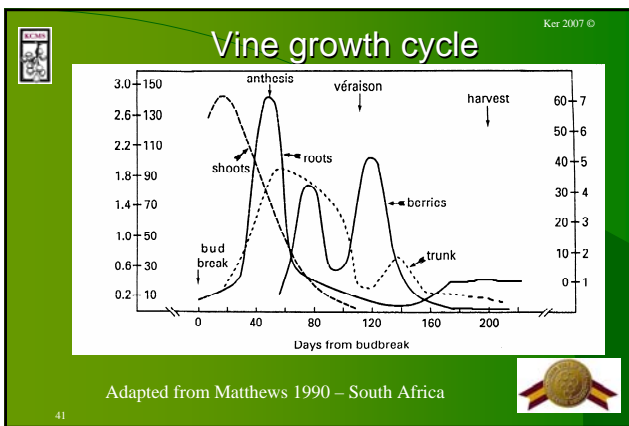
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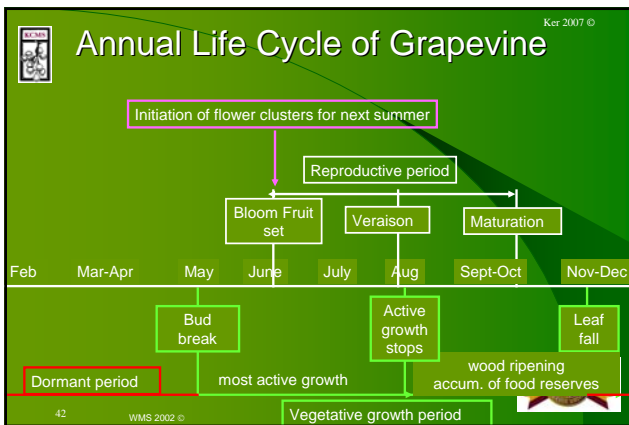
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