Monitoring Soil Moisture and Plant Water Stress

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Irrigation of Wine Grapes

- What are we trying to accomplish?

Irrigation of Wine Grapes

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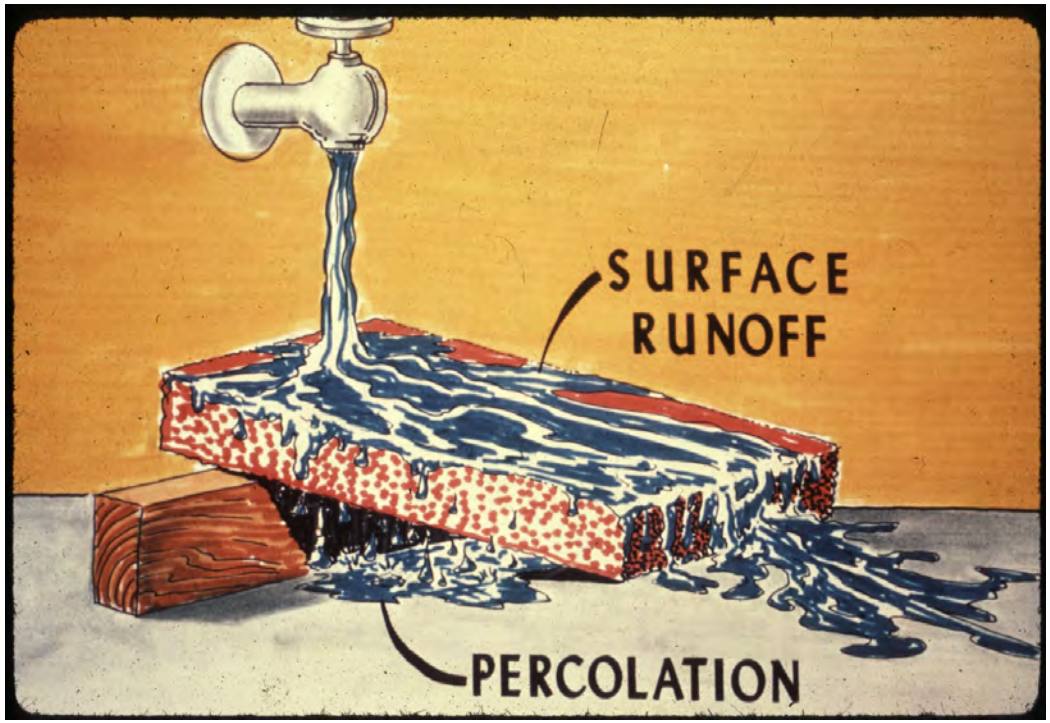
  - **Apply the correct amount of water without wasting any.**



Irrigation of Wine Grapes

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- **How do we apply that amount?**

Irrigation of Wine Grapes

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  - That is Irrigation Scheduling.
- How do we apply that amount?
  - **Know your irrigation system's application rate and its uniformity (how evenly water is applied).**

Irrigation Scheduling of Wine Grapes

Irrigation Scheduling - Methods

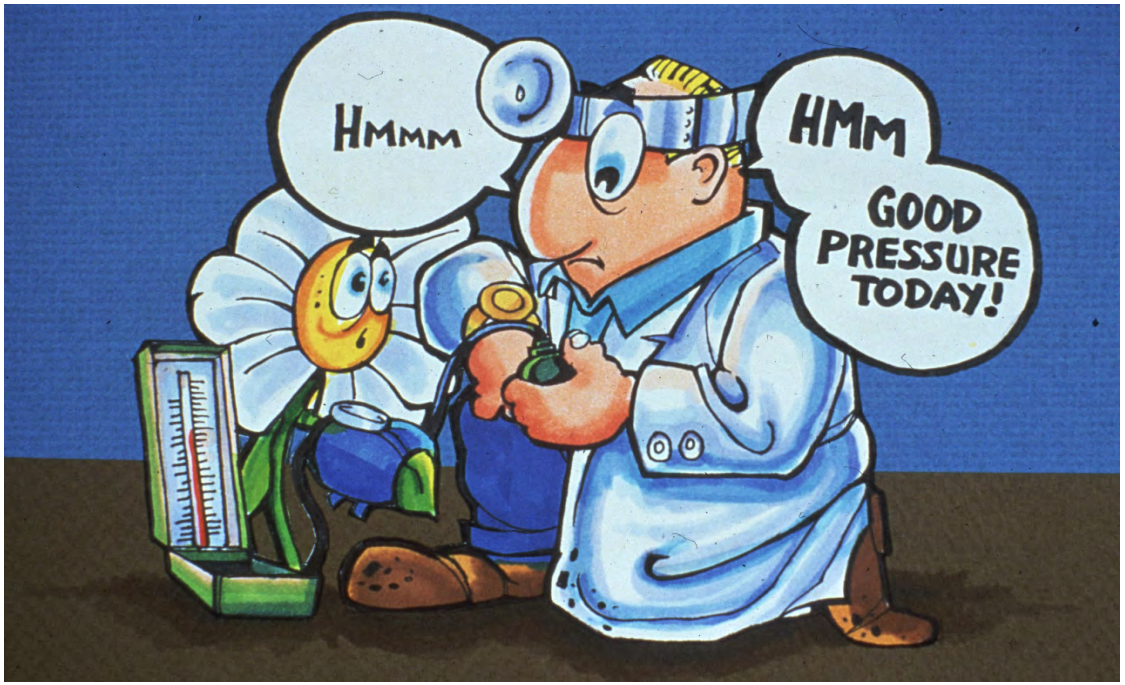
1. Monitor the plant.
2. Monitor the soil.
3. Monitor the weather.

Irrigation Scheduling - Methods

- **Monitor the plant.**
- Monitor the soil.
- Monitor the weather.

Plant monitoring:

- **We'd like to be able to measure some plant function which would tell us when the plant needed water.**



Plant monitoring:

- **Plant monitoring tells us *when* to irrigate, but it doesn't tell us *how much* to irrigate.**

We'll talk more about this.

Irrigation Scheduling - Methods

1. Monitor the vine.
2. **Monitor the soil.**
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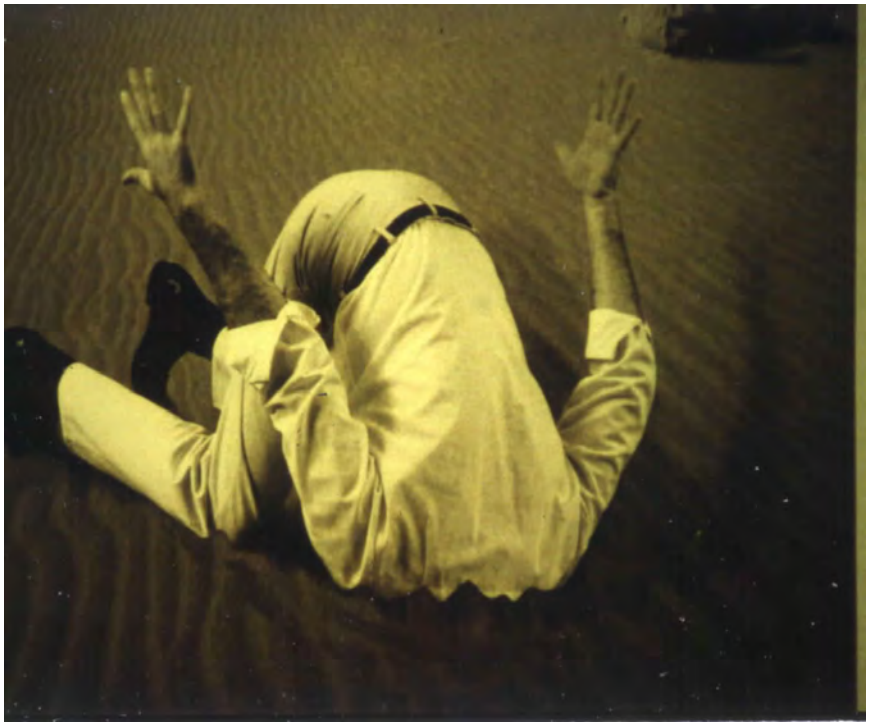

Soil Moisture Monitoring

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- **If the soil is dry, then the vine should need water.**
- **If the soil is wet, the vine should have sufficient water.**

Soil Moisture Monitoring

- We assume what is happening in the soil is reflected in the vine.
- **We can monitor the soil by hand, but we often use "tools" to make it easier.**
  - ***We'll talk more about those.***

Irrigation Scheduling - Methods

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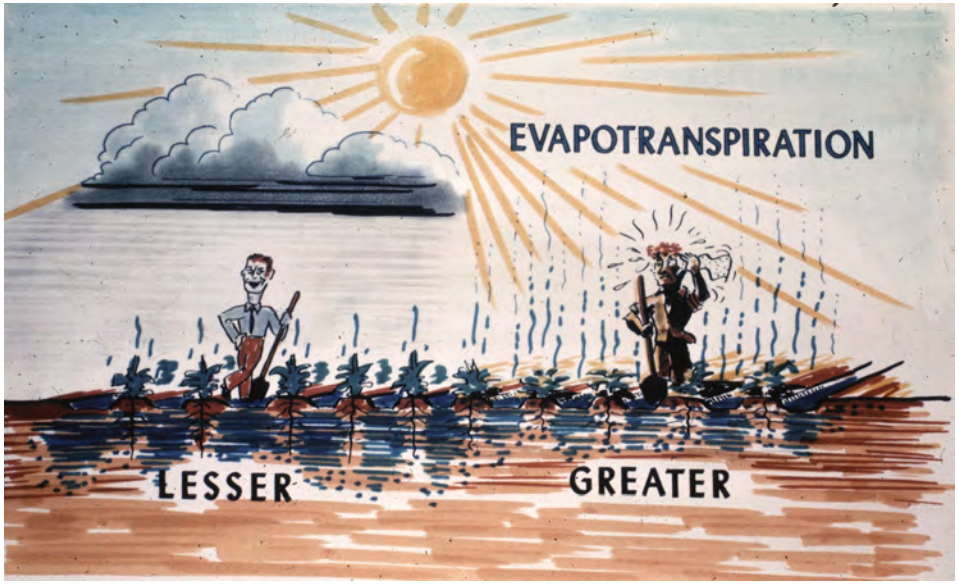
2. Monitor the soil.
3. **Monitor the weather.**

Weather-based Irrigation Scheduling

Monitor the weather and use it to estimate crop water use (ET).

Rhonda will talk about that.



Soil Moisture Monitoring - Details

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  - **Not a bad assumption as long as the soil moisture monitoring is accurately reflecting what the vine is experiencing.**

Soil Moisture Monitoring

- What are we doing with soil moisture monitoring?
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    - **Biggest limitation of <u>all</u> soil moisture monitoring is locating instruments at sites which are representative.**

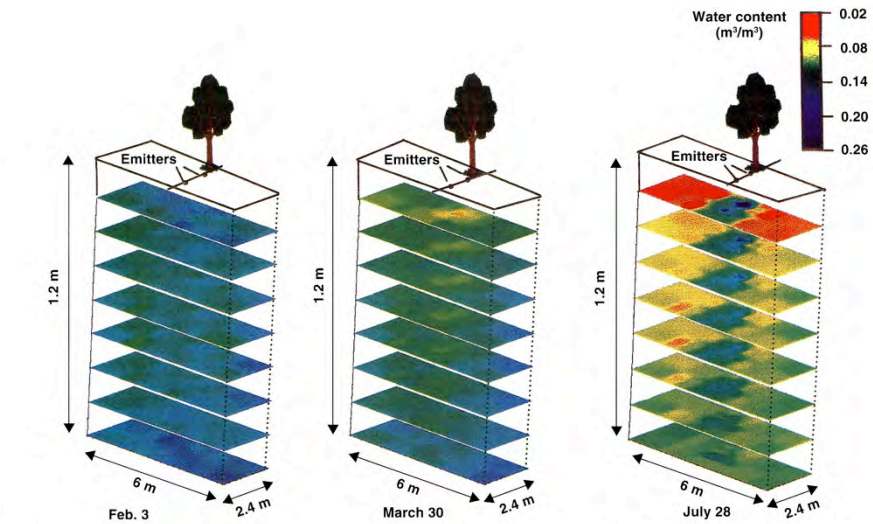

Fig. 1. Soil moisture distribution around an almond tree for 3 days in 1995: Feb. 3, soil moisture profile refilled by winter rains; March 30, soil moisture profile just before beginning irrigations; and July 28, soil moisture profile typical of that under surface drip irrigation during the growing season.

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      - **Even a bigger challenge when using drippers since soil moisture can change significantly in just a short distance.**

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- So why then do we do soil moisture monitoring?
  - It is still an excellent way of determining the level of soil moisture and this tells us the level of water available to the tree.
  - It can give you info. on where your irrigation water is going. Is it staying in the root zone? Going below the root zone? Are you irrigating too little? Irrigating too much?

Soil Moisture Monitoring

- What is “old” and what is “new”?
  - Instruments
  - Services

Soil Moisture Monitoring - Instruments

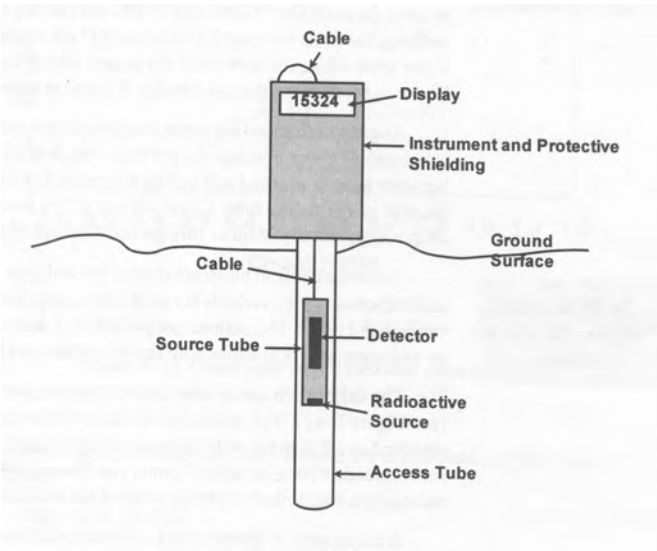
- Tensiometers and "old-fashioned" soil moisture blocks are still out there and they still work very well. Don't forget them just because they aren't new!

Watermark Block

Tensiometer

Soil Moisture Monitoring - Instruments

- Tensiometers and "old-fashioned" soil moisture blocks.
- **Neutron probes are also available.**
  - **Very accurate - usually done as a service due to the cost and radioactive safety requirements.**

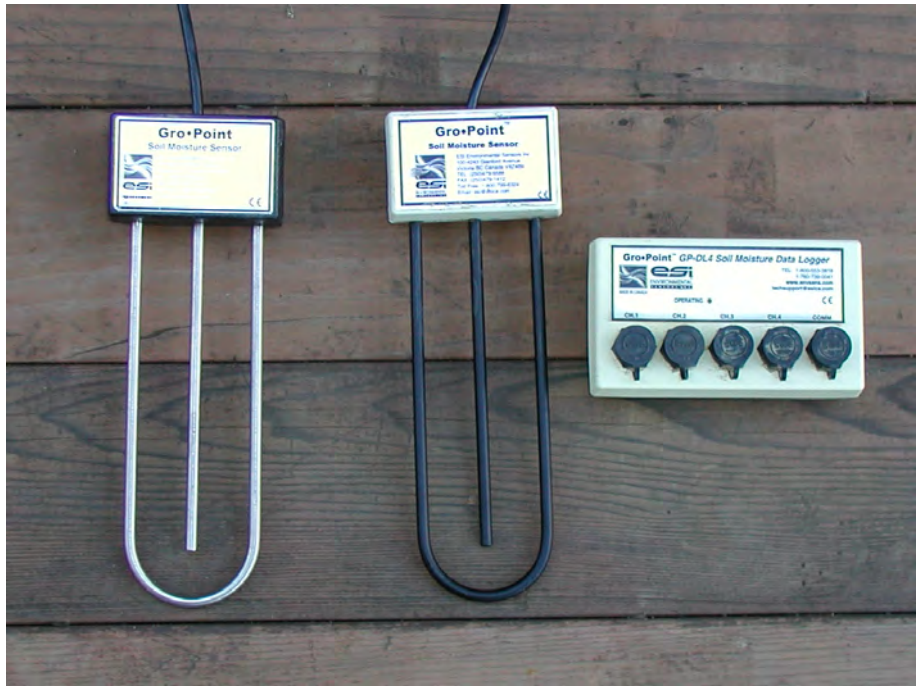


Soil Moisture Monitoring - Instruments

- Tensiometers and “old-fashioned” soil moisture blocks.
- Neutron probes are also available.
- **Many new soil moisture monitoring instruments are based on a dielectric constant principle.**

Dielectric Constant Devices

- Dielectric constant is a measure of the ability of a material to establish an electric field.
  - The dielectric constant for soil is much different than for water.



Soil Moisture Monitoring - Instruments

- Tensiometers and "old-fashioned" soil moisture blocks.
- Neutron probes are also available.
- Many new soil moisture monitoring instruments are based on a dielectric constant principle.
  - **These devices lend themselves well to being automated and logging (storing) data.**

Note: "old-fashioned" soil moisture blocks can do this too.

Soil Moisture Monitoring - Services

- This is where the most changes have been made.
- Services range from:

"You do everything"

to

"They do everything"

Soil Moisture Monitoring - Services

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- Lots of changes in how info. is collected in the field and delivered to you. Including remote retrieval and info. being made available to you on your own protected web page.
- **The more and fancier the services you get, often the more it costs.**

Soil Moisture Monitoring - Services

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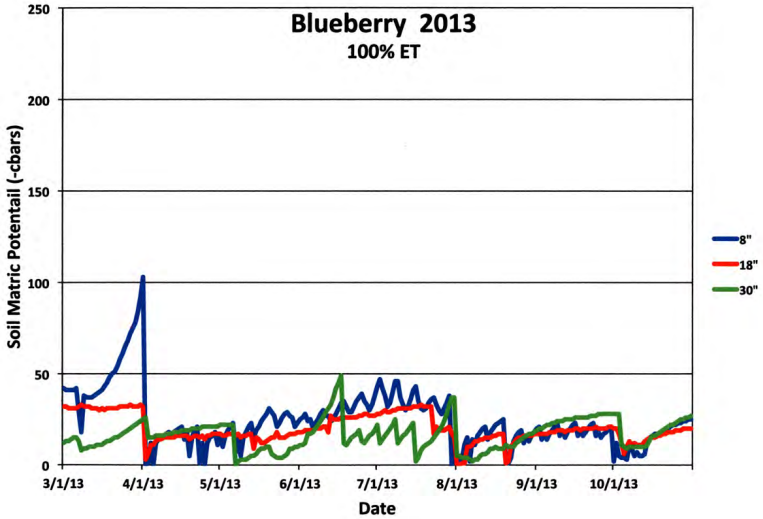
    - **Pay special attention to the graphics software they use to present the soil moisture info. to you.**



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    - Pay special attention to the graphics software they use to present the soil moisture info. to you.
    - **Do you just want soil moisture info., or do you want expertise?**

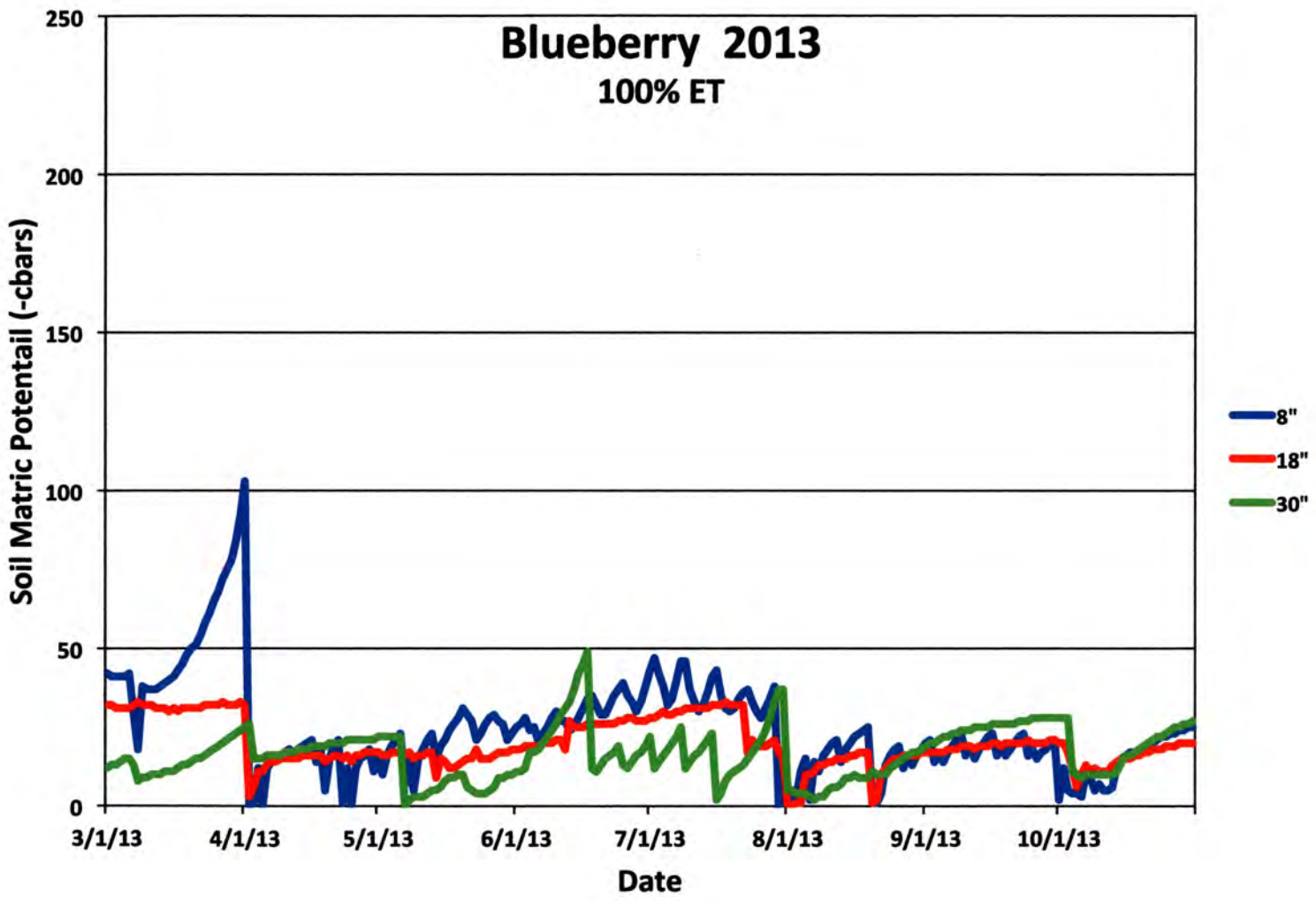
Soil Moisture Monitoring

- **Things to watch out for:**
  - **Just because you get soil moisture information provided to 4 decimal places doesn't mean it is accurate. Watch your vines!**

Soil Moisture Monitoring

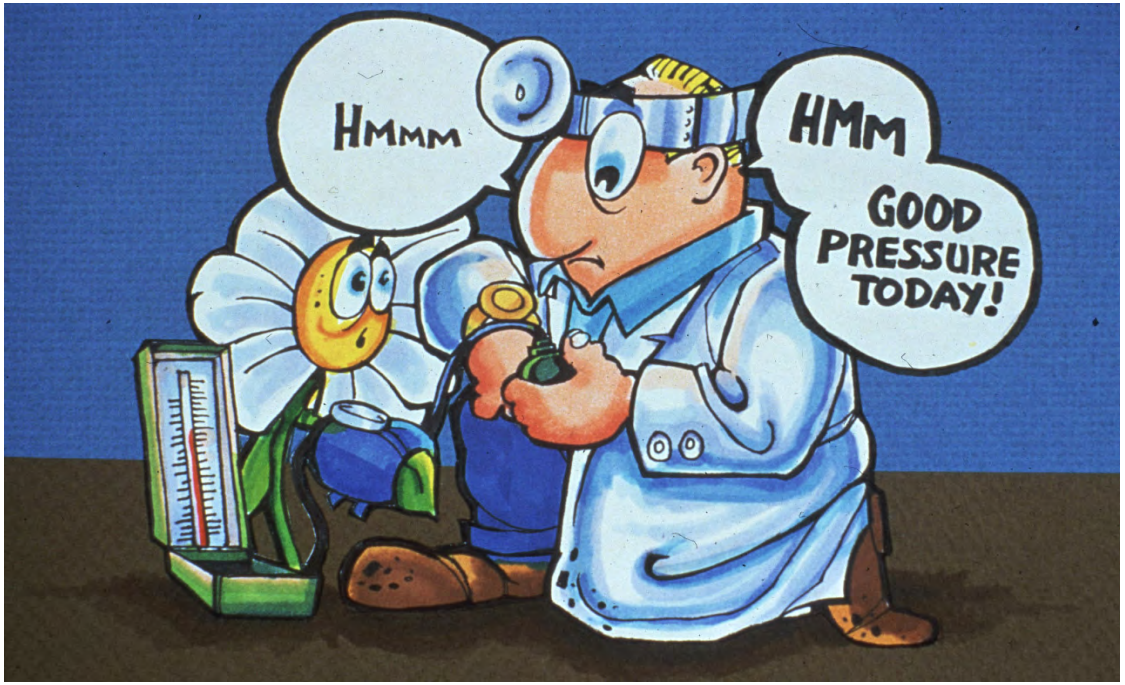
- Things to watch out for:
  - Just because you get soil moisture information provided to 4 decimal places doesn't mean it is accurate. Watch your vines!
  - **Don't get overwhelmed with soil moisture data. It is hard to keep up during the season – in time to do anything about your irrigations. Getting info. in a good visual / graphic form is often very useful.**

Soil Moisture Monitoring



Plant Monitoring - Details

- Measuring the vine provides information on its moisture status.



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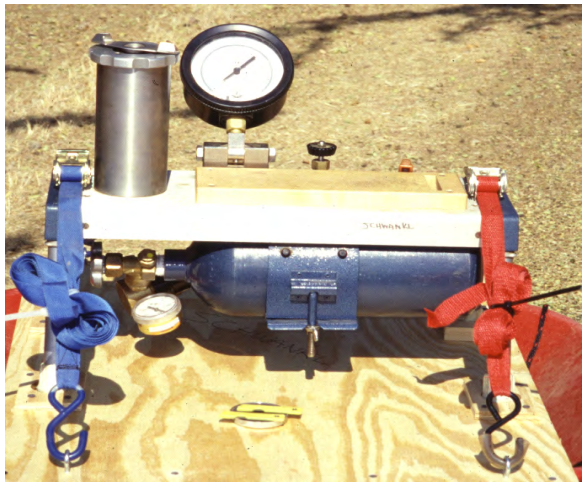
  - **Relatively new approach (infrared thermometers, pressure chambers, etc.).**



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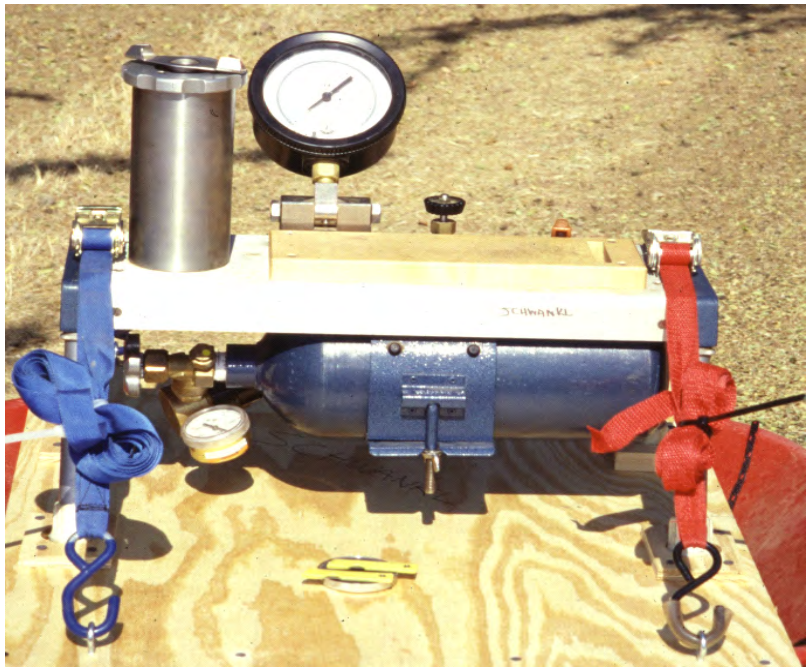
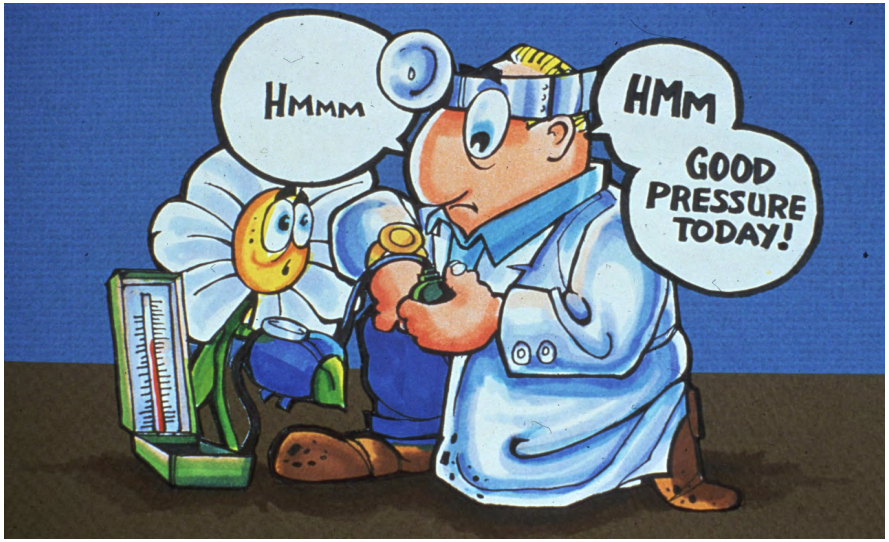
Plant Monitoring

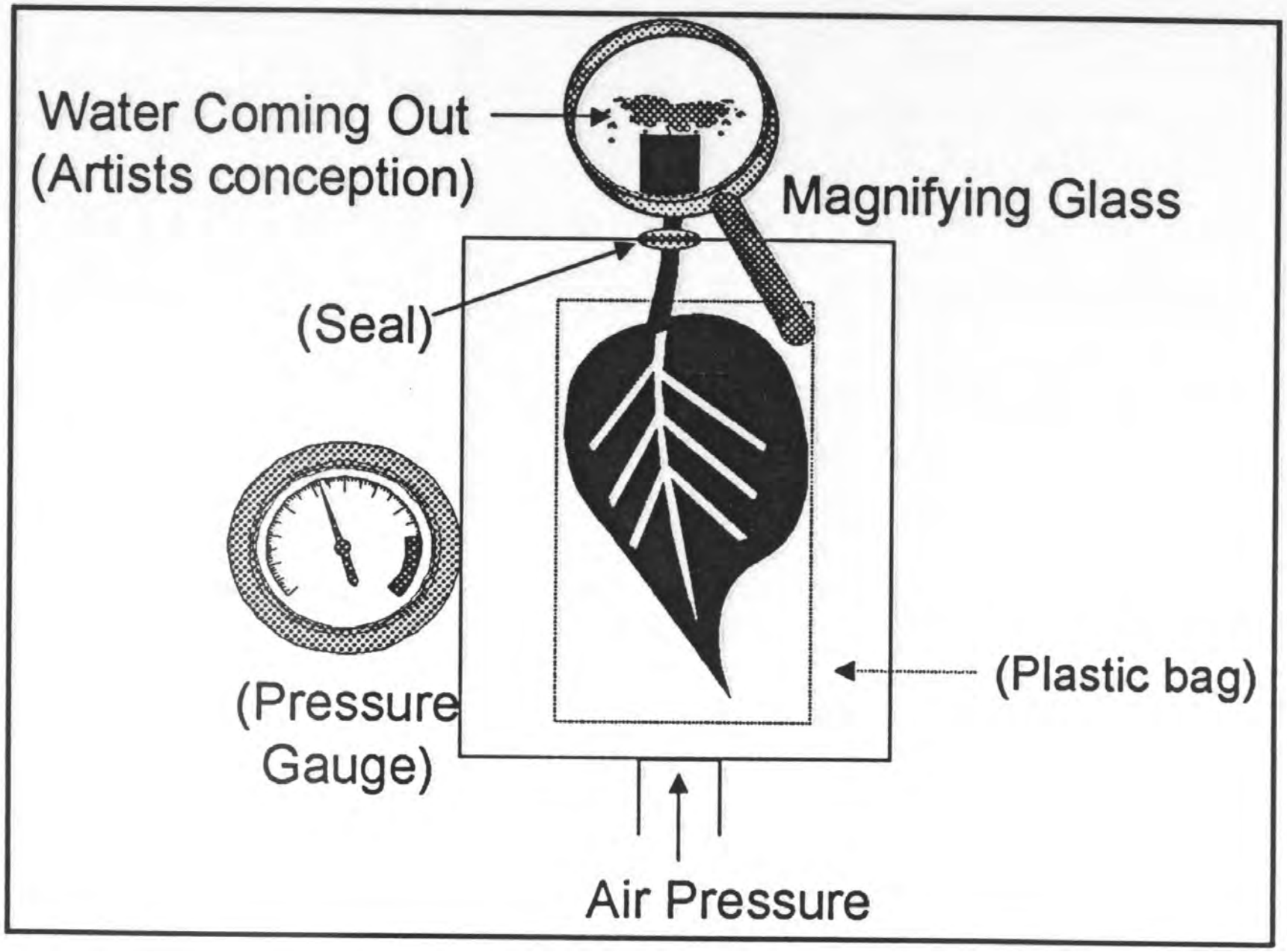
- Measuring the vine provides information on its moisture status.
  - Relatively new approach (infrared thermometers, pressure chambers, etc.).
  - Information available for some crops & not for others.
  - Methods tend to be labor intensive – working towards automation.
  - Readings tell you <u>When</u> to irrigate (plant is stressed) but not <u>How Much</u>.
    - How much water is needed can be learned with experience or by coupling plant monitoring with other approaches (i.e. ET).

Plant Monitoring – Pressure Chamber

- Measuring the vine provides information on its moisture status.
  - The pressure chamber (pressure bomb) is the most commonly used and most researched for wine grapes.

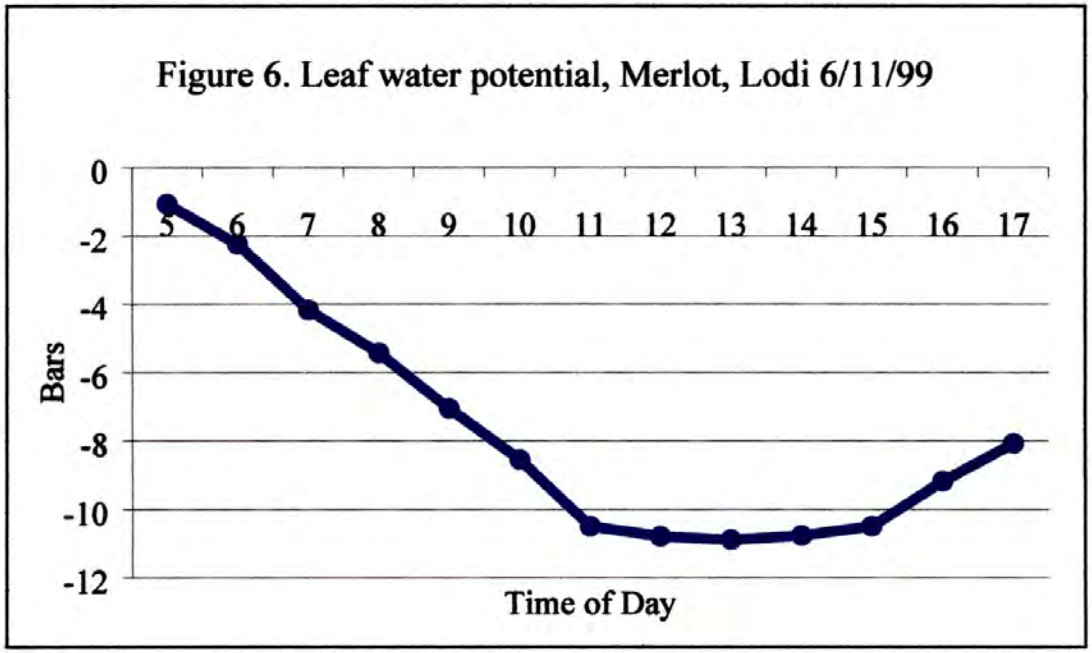





Water Coming Out
(Artists conception)
Magnifying Glass
(Seal)
(Pressure
Gauge)
(Plastic bag)
Air Pressure

Pressure Bomb Use in Wine Grapes

- Measurements taken at midday (noon to 2 PM).
- Units are in Bars (actually minus Bars)
  - 1 Bar = 14.7 psi



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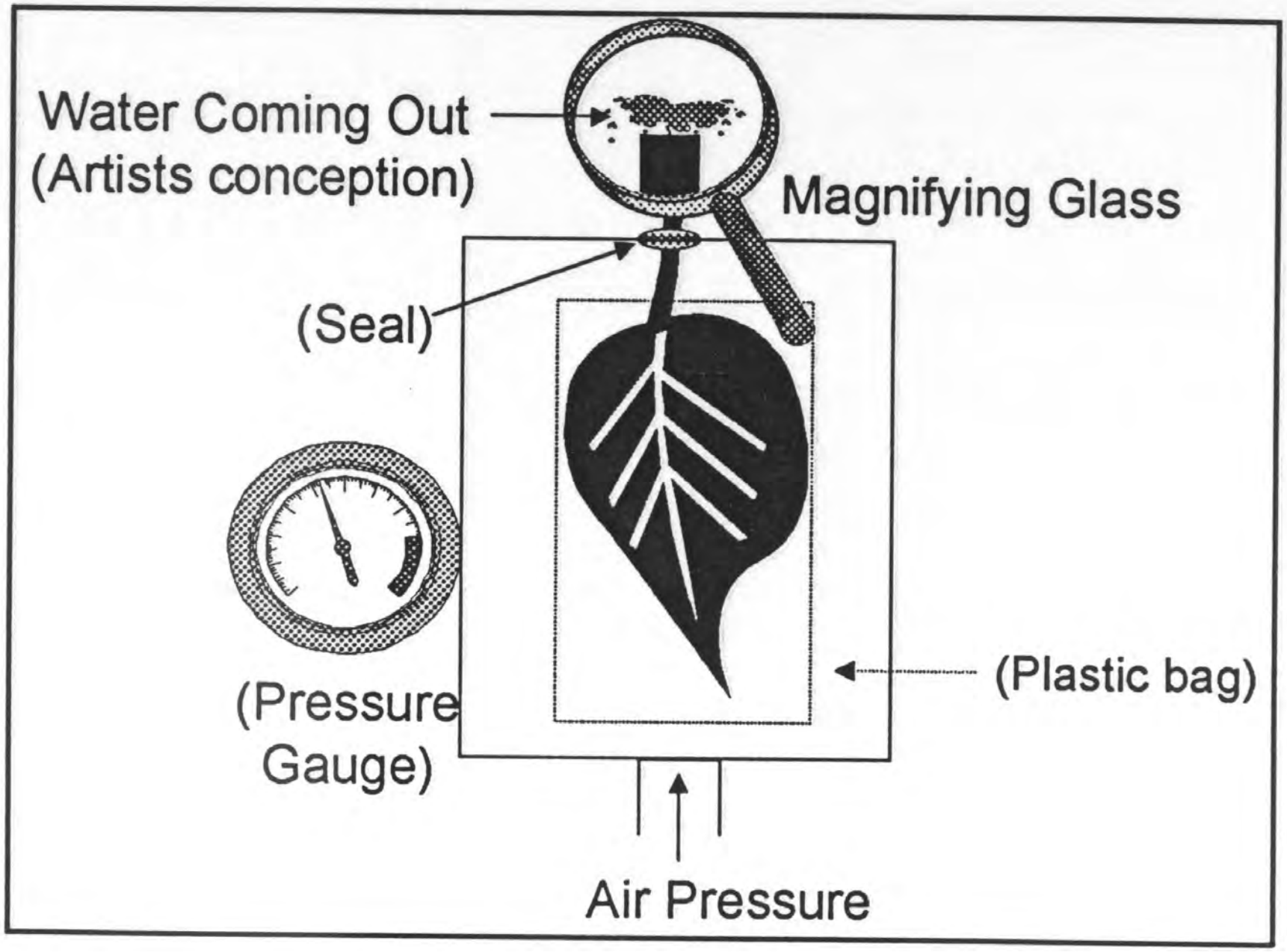
- **Collecting leaves** – cover with plastic bag, then snap leaf off of vine. Recut end of petiole with razor blade.
- **Taking Measurement** – insert petiole through sealing ring in chamber lid. Place leaf into chamber and seal lid.
  - Using hand lens, watch end of petiole while increasing pressure in the chamber. End point is when water comes out of the cut end of the petiole.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TOYOTA SANBORN TOYOTA
SUBDIV
5.0 psi
0.2 bar/20 kPa
MADE IN U.S.A.
SOILMOISTURE EQUIPMENT CORP.
SANTA BARBARA, CA U.S.A.
SCHWANKL

Pressure Bomb Use in Wine Grapes

▪What do the values mean?

Table 1. Levels of winegrape water deficits measured by midday leaf water potential		
1	less than -10 Bars	no stress
2	-10 to -12 Bars	mild stress
3	-12 to -14 Bars	moderate stress
4	-14 to -16 Bars	high stress
5	above -16 Bars	severe stress

Questions???

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