President's Message

Well, if you are as busy as I am, you probably don't have time to read this note, so I will make it short. Harvest is in full swing, with lots of truckloads of grapes headed for wineries h ere in the valley and north. We have luckily avoided the plague of forest fire smoke we've endured the last few years. Cooler weather has slowed down the ripening process, which is good. I would much rather pick when flavors are just right than have to pick when the sugar levels demand.

Greg Jones has a weather and climate update (see below), and when his report does not coincide with the Newsletter, his report is always posted at our website, rvwinegrowers.org. Check it out.

We will finally have our long awaited SOREC Viticulture specialist later this month. Alexander Levin starts at the station in Central Point and will be doing everything he can to get acquainted with the territory. Luckily, his visit in July to our vineyard tour and picnic gave him a head start. We are very lucky to have him, along with a new plant pathologist who will be starting at SOREC in the near future. We will plan a welcome "meet and greet" for both of them in the near future.

I wish you all a bountiful and safe harvest. After our beautiful summer, let's hope we have an equally beneficial fall season to bring all the fruit in. paz—John

Grapes for Sale

For sale by Paradox Vineyard, Ashland, Or.
Approx. 1 Ton of top quality Tempranillo grapes, ready early Sep. 2016.
Please call Bryant or Baiba Calhoun at 541 488-0074

I have up to 5 tons of Viognier to sell. $1900/ton. Will deliver in the Rogue Valley. Pearl Family Vineyards (775-745-5605).

20-25 tons of Pinot Noir, mix of Pommard and Wadensvil. VSP trellis, drip irrigated when needed, disease-free from a clean vineyard in the heart of Illinois Valley. Price/ton is negotiable. For more information, please contact Vanessa Braeley, Draper Valley Farms at 407.461.7770. Site visits welcome.

10+ tons of Chardonnay, UC Davis 108, very healthy, great color, VSP trellis, drip irrigated when needed, disease-free from a clean vineyard in the heart of the Illinois Valley. Price/ton is negotiable. For more information, contact Vanessa Braeley, Draper Valley Farms at 407.461.7770. Site visits welcome

The vineyard is in good shape and was luckily when purchase, we have been pruning with a small crew since acquisition and are thinking we will be harvesting early-mid September

Summer to Harvest Weather/Climate Update and Forecast

With school and football season starting a hint of fall is right on time and the transition has started (see forecast periods). But first let's look back at August … the month lived up to the forecast in some ways but differed in others. Temperatures were mixed with inland California, western Nevada, Oregon and Washington all seeing above normal conditions (2-4°F) which was spot on with the forecast (Figure 1) while eastern Washington and Oregon along with much of Idaho experienced near normal temperatures during the month. On the other hand, central coastal California experienced a fairly strong marine layer and fog, resulting in temperatures 1-2°F below normal, while much of the Great Basin and Rockies were cooler than normal due to monsoon cloud cover during the month (missed in the forecast). In terms of precipitation, the bulk of the western US was much drier than normal during August (Figure 1), however remember it does not take much to be drier than normal during this month. Nationwide, the dry conditions in the west gave way to much wetter than average conditions from Texas and the Gulf Coast up the Mississippi and Ohio river valleys and into the upper Midwest and Great Lakes while the eastern seaboard was close to normal rainfall (not shown). The nationwide temperature pattern in August was a west, central, east pattern with a generally warm west coast, cool Rockies to the plains and then a very warm eastern third of the country from the Mississippi River to the southeast and into New England (not shown).

Figure 1 – Western US August 2016 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Cumulative conditions since the first of the year continue to show a largely warmer than normal 2016 throughout the western US with precipitation amounts mixed (Figure 2). Average temperatures for the period have run 1-4°F or more above the 1981-2010 climate normals for much of California, Oregon, Idaho and Washington. While portions of Montana and the Dakotas have been 5-6°F above normal, areas in eastern Nevada and the Four Corners have been closer to normal for the year to date. This pattern continues across the entire US, with temperatures running 1-3°F above normal in most regions but 5°F or more above normal in the northern Rockies and Plains states and closer to normal in southern Texas and the Four Corners area of the southwest (not shown). For 2016 precipitation amounts have been 90 to 150% of normal from Northern California into southern Oregon, central Washington and portions of the northern Rockies (Figure 2). Dry conditions have been seen across eastern Oregon into Idaho and eastern Montana along with Southern California and across the southwest. The wetter than

average conditions extends out of the northern Rockies and into the Great Plains then south into the Mississippi and Ohio river valleys, while portions of the eastern US have been drier than average so far this year (not shown).

Figure 2 – Western US year to date (January through August 2016) temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Following the general spatial temperature patterns in Figure 1 and 2, growing degree-days continue higher than normal over most of the western portions of California, Oregon, and Washington (Figure 3). January through August accumulations are running near normal up to 500 units higher than the 1981-2010 normals throughout much of the western wine regions. GDD accumulation in August was higher than average in most regions, with the exception of eastern Washington/Oregon and portions of the North and Central Coast of California. The growing season continues to run roughly 10-20 days ahead of the long term average across the majority of the western, but is now almost guaranteed to end up lower than 2015 (see the Appendix Figure 1 for four locations in Oregon).

Figure 3 – Western US January through August 2016 growing degree-days departure from the 1981-2010 normals (image from Climate Impacts Research Consortium, University of Idaho).

Drought Watch – Again not much change from last month with western US drought conditions lessened in some areas but expanding in others. Conditions since the first of the year have also not changed much with central and southern California and into the southwest and Great Basin continuing to be very dry (Figure 4). The US seasonal drought outlook forecasts that the driest regions in California, Nevada and eastern Oregon will likely persist through the end of November and beyond. Some drought removal is likely along coastal Oregon and in Arizona as the monsoon season is expected to pick up over this time period.

Figure 4 – Current US Drought Monitor and seasonal drought outlook.

La Niña Watch – Not much change from last month … But would like to remind everyone this space has shifted from focusing on El Niño to paying more attention to potential La Niña developments. The shift to cooler surface waters in the tropical Pacific across the equator toward the central Pacific reflects the continued waning of El Niño and the developing La Niña conditions. Prediction models are in agreement that La Niña development is extremely likely by fall. If the transition into La Niña conditions by fall materializes, the western US would likely experience a colder and snowier winter. However, many forecasters are hedging their bets lower with moderate to minor La Niña development. But all forecasters are saying that we should not expect this La Niña to follow 'normal' conditions from the western to eastern US due

to Arctic warmth. I will monitor this over coming months as there is some lead time forecasting that can come from knowing the combined conditions in the tropics and north Pacific (see below).

North Pacific Watch – Again some changes here, but not dramatic or straightforward. Warmer than average sea surface temperatures (SST) along the west coast in the North Pacific continue (Figure 4). While the warm pool has expanded from June/July to today, the magnitude and spatial extent of the warm waters has declined from the conditions seen during 2012-2015. The cooler than average conditions out over the central North Pacific also extends further east and covers a greater area than the last few years. The expansion of the warm pool in the North Pacific in August should support a warmer than average ending to the growing season, but there is some indication of early shifts in circulation coming off of Siberia that might bring earlier than anticipated fall troughing and low pressure systems across the North Pacific and into the PNW. We have seen some early evidence of this effect with some flip-flopping in the position of the North Pacific high pressure area. Long range forecasts are typically driven by conditions in the North Pacific and the state of ENSO in the tropics. If we continue to see a shift to cooler waters in the North Pacific AND the tropics continue to transition to La Niña, the western US will likely shift into a cooler regime, especially into the fall and winter.

How conditions in the tropical and north Pacific set up in the next 15-45 days will be the key in better understanding how the end of the season and winter will play out. As such I will monitor how it evolves over the next few months.

Figure 4 – Global sea surface temperatures (°C) for the period ending September 1, 2016 (image from NOAA/NESDIS).

Forecast Periods:

6-10 Day: Our Labor Day weekend and into next week is dominated by a shortwave trough that will spun off systems into the PNW and west. The conditions will result in relatively cool temperatures for this time of year, but is not likely to produce much in the way of precipitation (very isolated and likely confined to more northerly areas of Oregon, Washington and British Columbia). The 6-10 day outlook from the CPC reflects this pattern with a high likelihood for a warmer than normal period from southern Oregon into southern California and the western Great Basin. Western Washington in the inland PNW and the northern Rockies have a greater chance of being cooler than normal. The 6-10 precipitation outlook shows the northerly track of these early low pressure systems with higher than average rainfall likely in the far north of the PNW, with either more normal or slightly drier conditions south into Oregon and California.

8-14 Day: Main shift from the 6-10 period is a warm up over most of the west that will bring conditions above normal into the middle of the month. The CPC outlook expands the likelihood of warmer than normal conditions from southern California into western Washington, and shifts the cooler than normal outlook into the Rockies. The precipitation forecast during this

period shifts the entire PNW to having a higher likelihood of drier than average conditions while California and the southwest are likely to be closer to normal.

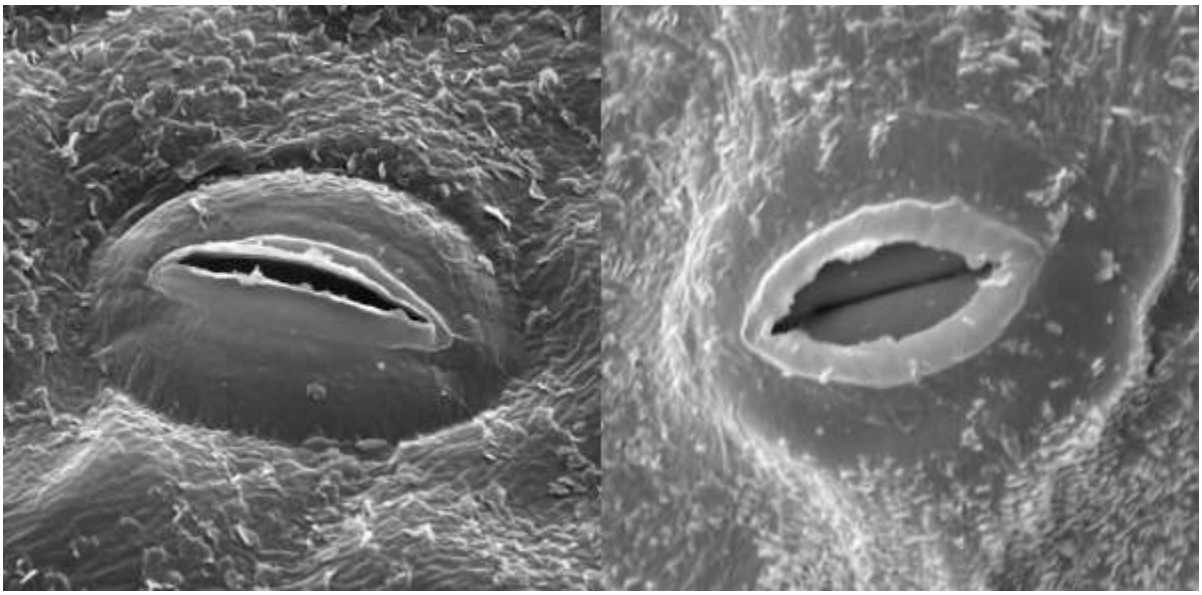
30 Day: Combining current conditions and the short outlooks above, the 30 day forecast for the month of September points to the month having a greater chance of warmer than normal conditions through the west (see Appendix Figure 2). The cooler pattern into the inland PNW and northern Rockies is forecast to likely continue throughout the month. Precipitation during the remainder of September is forecasted to below normal in Oregon, with the rest of the western US having an equal chance to be slightly above average, normal, or slightly below average (in other words there is nothing indicating anything other than normal September rainfall amounts).

90 Day: The broken record continues from the majority of the forecast community with the September-October-November (SON) forecast pointing to the majority of the continental United States having elevated chances of well above average fall temperatures, according to the latest outlook from NOAA's Climate Prediction Center (see Appendix Figure 2). There are no substantial changes to the pattern in the western US with everywhere in California, Oregon, Washington and Idaho expected to see higher than normal temperatures. Like the temperature forecast, the precipitation forecast for the west does not change much from the September outlook, with much of the west forecasted to have an equal chance to be slightly above average, normal, or slightly below average, while portions of the Great Basin are forecasted to be drier than normal. However, it should be noted that some forecasters are calling for an early and stormy winter for the west that is forecast to start in mid to late October. As mentioned previously in the La Niña and North Pacific Watch sections, the SST and circulation developments over the next 15-45 days will be the key in better understanding how the fall and winter will play out.

Appendix Figure 1 – Cumulative growing degree-days (base 50°F, no upper cut-off) for McMinnville, Roseburg, Milton-Freewater, and Medford, Oregon. Comparisons between the current year (2015) and a recent cool year (2010), a recent warm year (2015) and the 1981-2010 climate normals are shown (NCDC preliminary daily data).

Appendix Figure 2 – Temperature (left panel) and precipitation (right panel) outlooks for the month of September (top panel) and September, October, and November (bottom panel) (Climate Prediction Center, climate.gov).

Grapes 101



Open (left) and closed (right) stomata. Stomata (plural of stomate) are the portal through which plants regulate transpiration and gas exchange. When closed, they restrict water use – but also restrict photosynthesis and carbohydrate production. As water deficits intensify, stomatal closure limits evaporative cooling and can delay ripening. Leaves heat up, and cellular function can be permanently degraded. Finally, leaves from basal nodes out start to senesce, dry up, and fall off the vine. Photos by (L) Bhaskar Bondata, Washington State University and (R) Markus Keller, Washington State University.

How Grapevines Respond to Water Stress

Grapes 101 is a series of brief articles highlighting the fundamentals of cool climate grape and wine production.

By Tim Martinson and Alan Lakso

	2016 Rain[1]	Long-term Avg Rain[2]
April	1.17"	2.89"
May	1.66"	3.11"
June	0.65"	3.68"
July	1.01"	3.42"
August	0.80"	3.15"
Total	5.29"	16.25"

2016 precipitation totals for Geneva, NY. (1) Monthly rainfall totals up to 8/18/16. (2) Long-term average rainfall for the month (total). Table from the Finger Lakes Grape Program.

Water relations are a key factor in grapevine growth and development. Plants take up water to maintain cell turgor, to make and expand new tissues, to provide evaporative cooling, and to facilitate gas exchange for photosynthesis ($C0_2$) and respiration (O_2). Vines actively regulate the flow of water in response to environmental conditions.

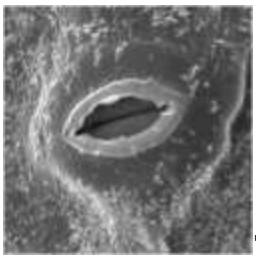
Water availability dramatically affects vine vegetative growth, fruit composition, and potentially winter hardiness. An overabundance of water is associated with excessive shoot vigor, canopy shading, and reduced fruit quality - and may delay the cessation of shoot growth and periderm formation, leading to poorer winter hardiness.

Moderate water stress at the right time can reduce vegetative growth and help vines achieve the appropriate balance between vegetative growth and fruit yield and quality. Severe water stress limits photosynthesis, and can delay ripening, reduce bud fruitfulness, reduce winter hardiness, and result in sudden vine collapse.

How does water move through vines? Water is taken up by the roots and moved through the xylem tissues (the pipeline) to leaves through water pressure differences. This process is driven largely by transpiration through stomata in the leaves and green tissue. As water evaporates into the atmosphere, this places water under tension, setting up negative water potential that draws water up through the vine – much like sucking water through a straw. Transpiration accounts for 95-98% of a vine's water use. Importantly, transpiration also provides evaporative cooling to keep sunlight-exposed leaves close to ambient temperatures.

Evapotranspiration. Evapotranspiration is a measure of water loss from the soil, including both transpiration (from plants) and evaporative losses from the soil surface. Evapotranspiration estimates (ET_0) use local weather data and a crop coefficient to estimate water use for irrigation scheduling.

When soil water is readily available, the rate of evapotranspiration is driven by temperature, wind, relative humidity, and canopy size. High temperatures, dry air, and wind drive water use higher. Large vines have more leaf area and use more water than small vines.



The stomate. Transpiration is controlled by stomata (greek word, plural of stomate). Abundant on the underside of leaves, stomata actively open and close to allow or restrict gas exchange. The two large cells, called guard cells, open and close in response to sunlight, water potential, and hormonal signals to regulate gas exchange. Stomata are often closed at night when there is no sunlight to drive photosynthesis. Under adequate moisture during the day, however, sunlight stimulates them to open to allow the vine to take up carbon (CO_2) for photosynthesis, and release oxygen (a byproduct of photosynthesis) and water vapor.

As soils dry out, evaporative demand can exceed the soil's ability to supply water. This places water under more tension (like a stretched rubber band) – potentially leading to formation of air bubbles or embolisms that interrupt the continuous column of water from root to leaf. Stomata, by opening and closing in response to environmental conditions, restrict and regulate the flow of water molecules to the atmosphere – and prevent embolisms from forming in the vine's vascular tissue.

In addition, dry soils cause roots to produce more of a plant hormone called abcissic acid (ABA), which also signals stomata to close, conserving water.

Closed stomata conserve water, but also restrict the vine's intake of CO_2 to use in photosynthesis. Vines respond in various ways:

Shoot growth slows. Shoot growth is one of the most sensitive indicators of water stress. Actively growing shoots (L) have long tendrils that extend past the shoot tip. Moderate water deficit slows growth, and short tendrils that don't extend beyond the shoot tip (M) signal slower growth. Under moderate to more severe stress (R) shoot tips will dry up and fall off.

Photos by Tim Martinson

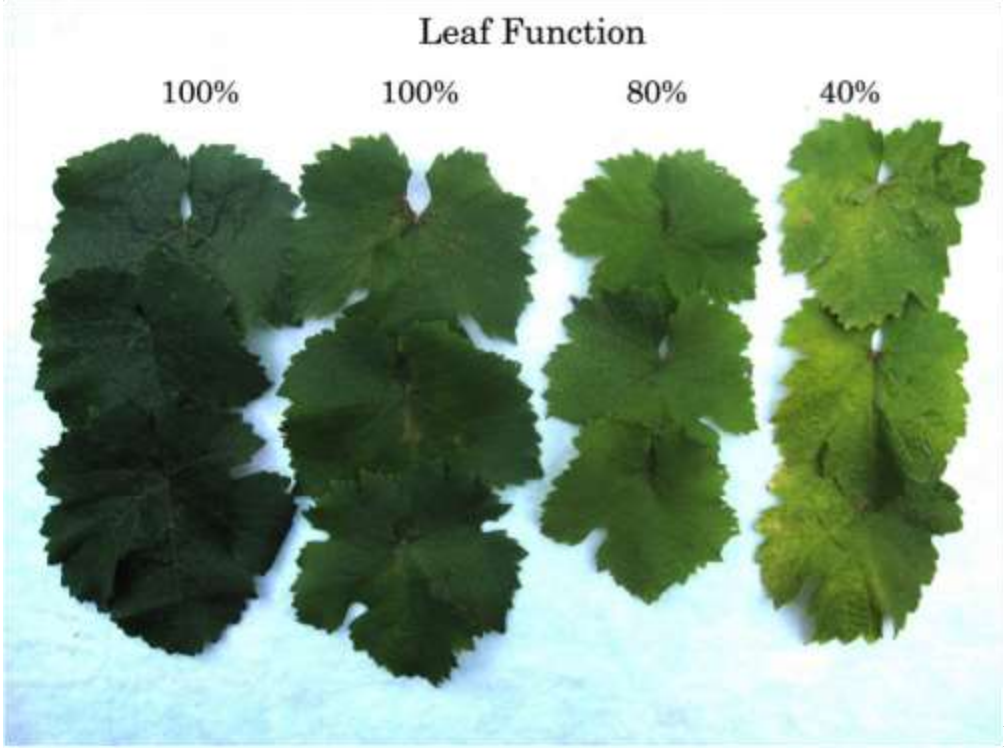
Tendrils dry up. Under moderate stress, tendrils further back from the shoot tip will first wilt (L) then dry out (M & R), rather than persisting and being lignified.

Photos by Tim Martinson

Leaves droop. As water stress becomes more severe, leaves will droop (L, M) and face away from the sun (R, looking South to North at noon). They may be warm, or even hot to the touch, signaling loss of evaporative cooling. With air temperatures close to 90˚F, leaves with closed stomata may reach 110-114˚F in the sun. If water is replenished through rainfall or irrigation soon enough, these symptoms are usually reversible.

Photos by Tim Martinson

Leaf bleaching. If vines lose their evaporative cooling and temperatures are high for more than a few days, they may take on a 'bleached' look, due to thermal breakdown of leaf tissues. This process is irreversible, and will permanently reduce vine capacity for photosynthesis.



Measurements and photo by Alan Lakso

Leaf senescence. If water stress continues, embolisms (air pockets) may form in leaf vessels or shoot xylem, and leaves will start to break down and senesce. In severe circumstances, vines or shoots will collapse.


Photos by Tim Martinson

Vine water use varies. Large vines (eg. Concords) use more water than smaller vines (Riesling). Divided canopies (such as GDC Concord) use 20-25% more water than single canopies.

Mid-summer Water Usage Rates

Variety/Training System	Acre-inches/week	Gal. per acre/week
Riesling	0.8-1.5	22-40,000
Concord High Cordon (Single Curtain)	1.2-1.5	32-42,000

Concord Geneva Double Curtain	1.4-1.7	38-45,000

Data from A. Lakso; assumes full canopy, no rainfall.

Soils have different water holding capacity. Soil texture and depth determine how much water soils can supply. Under estimated usage rates above, silty loams at field capacity can supply water for 6 weeks; sandy soils will run out of water in a week.

Water stress will affect vines on coarse, shallow soils earlier and more severely than vines on deep, loamy soils.

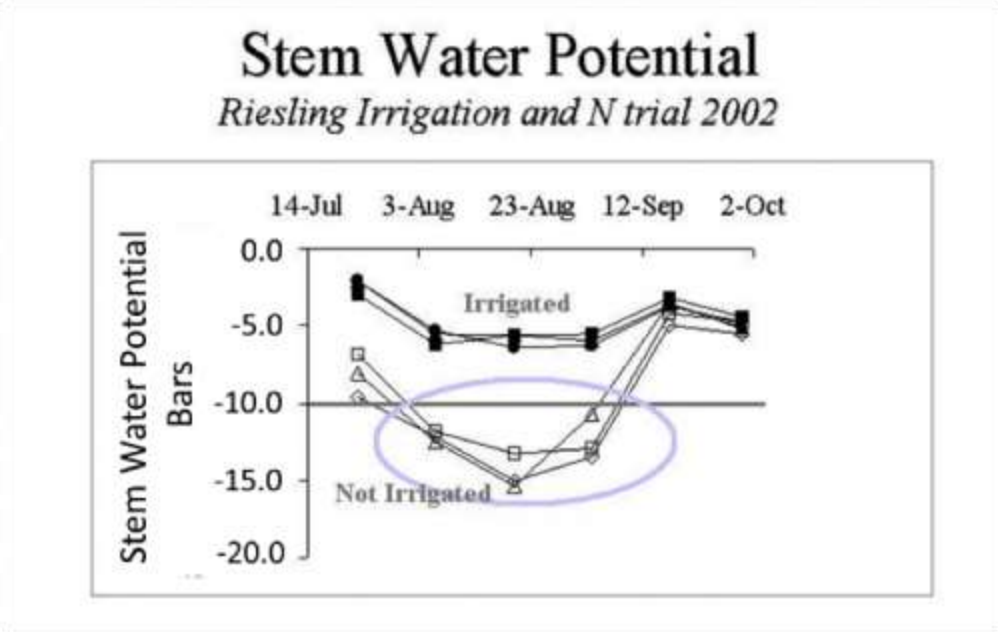
Water Holding Capacity of Different Soils

Soil type	Inches of water per inch of soil	Acre-inches of water in 24 inches of soil
Clay or Silty Loam	0.25	6.0
Sandy or Gravelly Loam	0.15	3.6
Loamy sand	0.10	2.4
Sandy	As low as 0.03	0.7

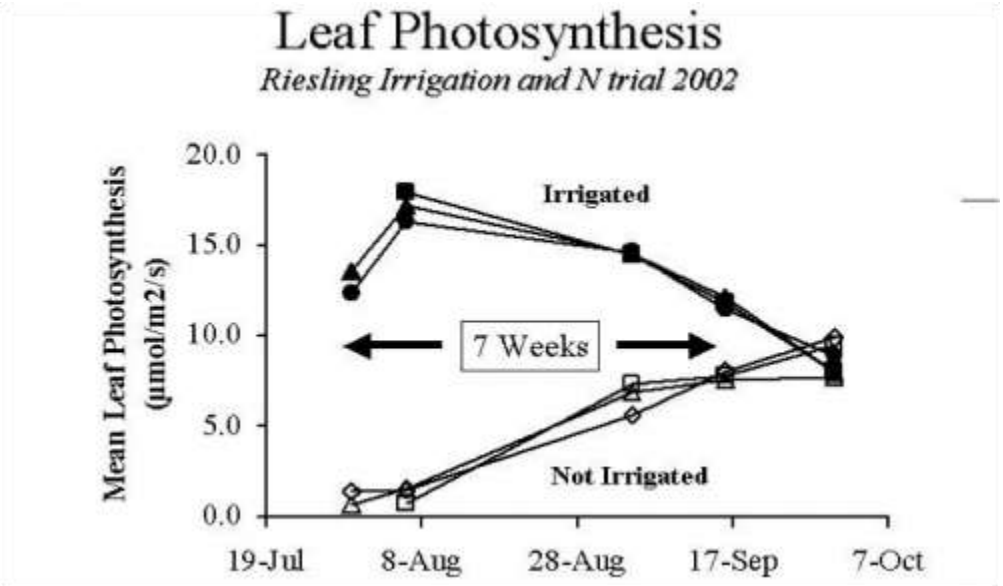
Source: A. Lakso

How much does water stress reduce vine function? In 2002, we conducted a study that looked at irrigation and foliar nitrogen and its impact on vine function, yield, and fruit composition in a vineyard with shallow soils. Drought that year brought us seven weeks from late July to early September with no rainfall.

We measured vine water status in irrigated and non-irrigated vine. Mid-day leaf stem water potential (a measure of water tension due to drought) was -12 to -15 bars from early August through the start of September in unirrigated vines, and -5 bars in irrigated vines. As a general reference, growers in irrigated production regions often start applying irrigation when stem water potential reaches -9 to -10 bars.



We also measured stomatal conductance (a measure of gas exchange through stomata and photosynthesis) in the same vines. Note that leaf photosynthesis was severely reduced at mid-day for about seven weeks – from a few weeks before veraison through the middle of the post-veraison ripening season.



This missing photosynthesis resulted in 3° Brix lower soluble solids in the unirrigated vines.

Yield Components at Harvest

Riesling Irrigation and N Trial 2002

Treatments Irrigation	N	Brix (%)		Yield (kg/vine)		Berry Wt (g)	Berry# (#/cluster)		Cluster Wt (g)	Cluster # (#/vine)
No	0	18.9		5.04		1.31	58.1		76.3	65.9
	Foliar N	18.5	**18.5**	5.42	**1.3**	1.36	56.5	**76**	77.0	70.1
	Soil N	18.4		5.78		1.33	56.5		74.9	76.5
Yes	0	21.7		5.57		1.82	42.8		77.9	72.1
	Foliar N	21.2	**21.5**	5.91	**1.7**	1.74	43.2	**76**	75.4	78.6
	Soil N	21.6		5.13		1.70	43.7		73.3	70.1
Significance (P)										
Irrigation		0.0001		ns		0.0001	0.0001		ns	ns
N		ns		ns		ns	ns		ns	ns

P VALUES INDICATE THE SIGNIFICANCE LEVEL. NS: NON-SIGNIFICANT.

Finally, pruning weights in the irrigated vines (following two dry years) were twice those of the unirrigated vines.

Pruning Weights 2002-2003

Treatments Irrigation	N	Pruning Wt (lb)
No	0	0.87
	Foliar N	1.17
	Soil N	1.10
Yes	0	1.89
	Foliar N	1.80
	Soil N	1.76
Significance (P)		
Irrigation		<0.001
N		ns

This example illustrates how water stress – particularly in soils with limited water holding capacity – can reduce vine capacity in a dry year. Since soils vary greatly in depth and water holding capacity, the impact of the 2016 drought will vary from site to site. Growers with fertile, deep soils may see a welcome reduction in vine growth that may reduce the crop, but have a

modest impact on fruit ripening. Others with shallower soils and no irrigation may see delayed ripening and possible carryover effects in 2017.