Started 21 November 2016 - by Nicole Merrill

This experiment began in December 2015 with 351 cuttings of 50 varieties of winegrapes taken from the UC Davis Robert Mondavi Institute vineyard. They began growing in January 2016 and were then placed in the growth chambers set to 4°C during the day (18 hours) and 6°C during the night (6 hours) May 27, 2016. On August 15, 2016, the plants were removed from dormancy and placed in greenhouse 10 (see file greenhouse10\_winegrape\_position\_map) where temperatures were initially cooler (15.5-18°C at night, 18-21°C during the day) but were slowly ramped up to normal operating conditions (10°C at night, 23-28°C during the day).

The first step, once they came out of dormancy, was to prune the plants so that each spur had two nodes (often referred to as buds in the files). Pruning the plants as they came out of dormancy elicited “weeping” from the ends of the spurs where water, plants hormones, and nutrients leaked out. This moisture caused many of the plants to develop some sort of fungal growth which Kea then sprayed for and eliminated. To establish a baseline for each plant, the size of the nodes, the distance between the two nodes, and the diameter of the spur were all measured and recorded (see file baselinespursize).

August 22, 2016 was the first day that regular greenhouse observations began (see file phenmoist\_grapes2016). In order to determine the developmental stage of the plant, we used the modified Eichorn-Lorenz scale. We also monitored soil moisture of each plant in three different places in the soil. The goal was to take measurements at least twice a week in the greenhouse. Initially, making observations on all the plants took two days, so Monday and Tuesday would be the first round of weekly observation, and then Thursday and Friday would be the next round of observations for the week. Once interns were hired, however, each round of observations could almost always be completed in a day. Only three of the plants did not undergo budburst (see file budburstdate\_grapes2016).

Once a plant reached E-L stage 12 (inflorescence developing) the plant was randomly assigned to one of five growth chambers (see files plants\_in\_treatments and repsavailabilityofchambers), each set to a slightly different temperature. In the chambers, the plants experienced 12 hours of daylight with warmer temperatures and 12 hours of night with cooler temperatures. The mean temperature for each chamber was 20°C (Chamber 1), 26°C (Chamber 2), 30°C (Chamber 3), 34°C (Chamber 4), and 37°C (Chamber 5). Initially, CO2 was set to 400ppm during the day and 600ppm during the night, but CO2 controls or monitoring failed in one of the chambers September 17 or 18, and so were turned off in all chambers to limit variables between the chambers. In order to minimize the effects of the different types of chambers and each one’s own idiosyncrasies, the treatments (and whichever plants were assigned to that treatment) were rotated to a new chamber about every 10 days.

In the chambers, the developing inflorescence was contained in a small paper bag so that we could keep track of flowering by the number of dropped caps. September 9, 2016 was the first day of chamber observations. The length of the plants was measured with calipers, the leaves were counted, the percent of buds flowering was estimated, and the number of flower caps found in the bags around the inflorescence was recorded (see file chamberobservations\_grapes2016). Once the buds on the inflorescence were large enough and distinct enough, the vitisFlower mobile phone app was used to estimate the number of flowers on each inflorescence and the results were noted. Later in the experiment, dried up buds began appearing in the bags around the inflorescence as well, so the number of those found was also recorded. The plants were kept in the chambers until they had finished flowering.

As the experiment continued, many of the inflorescence that had developed showed increasing signs of distress such as buds drying up and falling off or the entire inflorescence shriveling up. This was noticed in the plants that were in the chambers as well as in the plants in the greenhouse (see file grapeslostinflor). When plants lost their inflorescence, their ID was added to a list along with their variety, the date the inflorescence was first noted as having been lost, whether the plant had begun flowering at all, what treatment the plant was in (if any), and how long the plant had been in the chamber (if at all). If a plant lost its inflorescence before it finished flowering it would be moved back into the greenhouse unless it had not been in the chamber longer than 14 days. If it had not been in the chambers for two weeks it was left in the chamber until that much time had passed so that the plant would be exposed to the temperatures for a base amount of time.

By the end of September, the rate of plants developing inflorescence had practically halted, and no more plants were moved into the chambers. Nearly all the plants in the chambers finished flowering or lost their inflorescence by mid-October, and all were out of the chambers by the end of the first week of November. In the end, 26 plants from 11 varieties were in the chambers. In the greenhouse, 24 other plants flowered but were not of the varieties used in the experiment, so 50 total plants from the original 350 flowered (see file floweringdate\_grapes2016). However, only 37 finished flowering; the rets lost their inflorescence.

November 17, 2016 was the last day of observations in the greenhouse. Since then, the process of photographing each plant has begun (see WeldShare>Wolkovich lab>Vitis>vitisheattolplants). Most of the plants will be thrown out once photographed, but seven varieties will be kept for further study: Gamay Noir, Cabernet Sauvignon, Syrah, Durif, Tempranillo/Valdepenas, Verdelho, and Marsanne. These plants will be repotted in larger pots and returned to the greenhouse to take root.