

IRRIGATION ACCORDING TO PMS AND TENSIOMETER INSTRUMENTS

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It has been my observation over quite a few years that forest nurserymen are an independent lot; they definitely have their own ideas as to how a nursery should be run. This was never more true than with irrigation practices. Most nurserymen seem to have an intuitive sense about when seedlings need water and when they don't. However, does this intuition always get the job done most efficiently and at the same time provide what the seedlings really need?

As I became acquainted with the pressure bomb (Pressure Chamber Instrument) and the tensiometer I was pretty well convinced that these tools would take out some of the guesswork in irrigation schedules. The pressure bomb measures plant moisture stress, or indirectly the amount of water it has taken in from the soil. The tensiometer measures the amount of available moisture in the soil, so with the two instruments we should pretty well figure out when and how much water is necessary for optimum seedling development.

After working the two instruments together to the point where there is good correlation between plant moisture stress (pms) and the amount of soil moisture stress we should be able then to determine watering schedules with the tensiometer alone with occasional checks with the pressure bomb. Not only would this provide optimum conditions for the seedlings, it just might, in addition improve efficiency of water use.

When I agreed to give this talk today I figured I would have two seasons to work out some pretty good data. It didn't turn out quite that way. Last year I couldn't get everything together with the private nursery I am working with; and this year we came up with a rather short growing season, at least at the beginning. Then, too, it would have helped if this meeting had been in October. As the study stands, the data are far from complete, but there are some pretty good indications that the system will work, and perhaps the results will serve this meeting with some food for thought, at least.

The private nursery that I'm working with is the Glass Mountain Nursery at the head of the Napa Valley near the town of St. Helens. The nursery is surrounded by grape vineyards. The soil is a sandy loam, just a little bit heavy for an ideal forest nursery soil, but with the management that is given it turns out some excellent quality seedlings.

Present nursery capacity is about 1.5 million seedlings, and the owners are looking at acquiring some more vineyard land to

expand. Species grown in greatest quantity are Douglas-fir, ponderosa and Monterey pine. Several other species are grown in smaller quantities to supply Christmas tree growers.

The operation is run by a father and son with two permanent employees. In addition to the nursery, they operate about 10 acres of a choose-and-cut Christmas tree plantation.

The climate at the nursery receives considerable coastal influence. Rainfall this past winter was about 60 inches. During the growing season maximum temperatures range from the mid 80's to mid 90's. This summer so far, two days of 100 plus degrees have occurred. Most nights and mornings there is coastal fog that helps keep maximum temperatures relatively low. Minimums are generally in the low 50's. One morning recently there was a 45 degree minimum. Soil temperatures are usually about 120 degrees which are cooled in the seed beds by irrigation to keep them below 105 degrees.

Our irrigation study was conducted in two beds of 1-0 ponderosa pine and two beds of 2-0 Douglas-fir. One 4 ft. by 8 ft. plot was arbitrarily selected in each bed and covered with plastic roofing to cut down on the water those plots received. The primary objective was to see if the amount of water applied in a season could be cut in half.

The study was started on July 7 of this year and will be continuing on to the time of the winter rains, so the data available so far are far from complete.

The 1-0 ponderosa pine was sown on May 20, and seedlings are now from 3-4 inches tall. The 2-0 Douglas-fir was cut under or wrenched on July 7.

The graphs (figures 1 and 2) indicate the kind of irrigation that was carried out at the nursery, and some soil moisture and pressure bomb readings. The objective of the study, to reduce by one half the amount of water applied didn't work out quite that way, but we were able to show results of some reduced watering.

The ponderosa pine 1-0 seedlings were watered mainly for cooling up until July 13. On July 21 the soil in the covered plots was getting quite dry, although stress on seedlings did not increase that much. In any event covers were removed until August 2. On August 5 soil moisture stress had climbed again; however, there was no plant moisture stress evident yet. From this information so far it appears that ponderosa pine will easily withstand fairly high readings of soil moisture stress. Perhaps a watering schedule of keeping soil moisture readings between 40 and 70 centibars will be sufficient during the growing season. One of the oversights in this project was not taking more readings outside of the covered plots. It will be noted that on August 5 both soil moisture and pms readings were taken outside of the plots.

The 2-0 Douglas-fir generated some different patterns. As mentioned earlier, this stock had been cut under not long before we started the study. The soil appeared to dry out much faster than in the ponderosa pine beds, probably because of the loosening of the soil from undercutting and the requirements of the larger, older stock. Soil drying and plant moisture stress increased much more sharply than in the ponderosa pine plots. It will be noted, too, that all of the irrigation was done to build up soil moisture and not to cool the soil. As with the ponderosa, covers were taken off of the plots and soil moisture was replenished when stress reached 80 centibars for soil and a pms of 10 and 13 bars for the seedlings.

As with the ponderosa plots, covers were placed on the Douglasfir plots again August 2, and as will be seen on the graphs stresses climbed rapidly again. Readings outside of the plots were high then also, as no water had been applied to the beds as of August 5. Watering was scheduled for late afternoon August 5. Readings were to have been taken by the nurseryman on August 7 or 8.

For irrigating 2-0 Douglas-fir under conditions of this nursery, indications are that soil moisture should be maintained between 30 and 60 centibars, in other words, let the soil dry to 60 centibars and then water to 30 centibars.

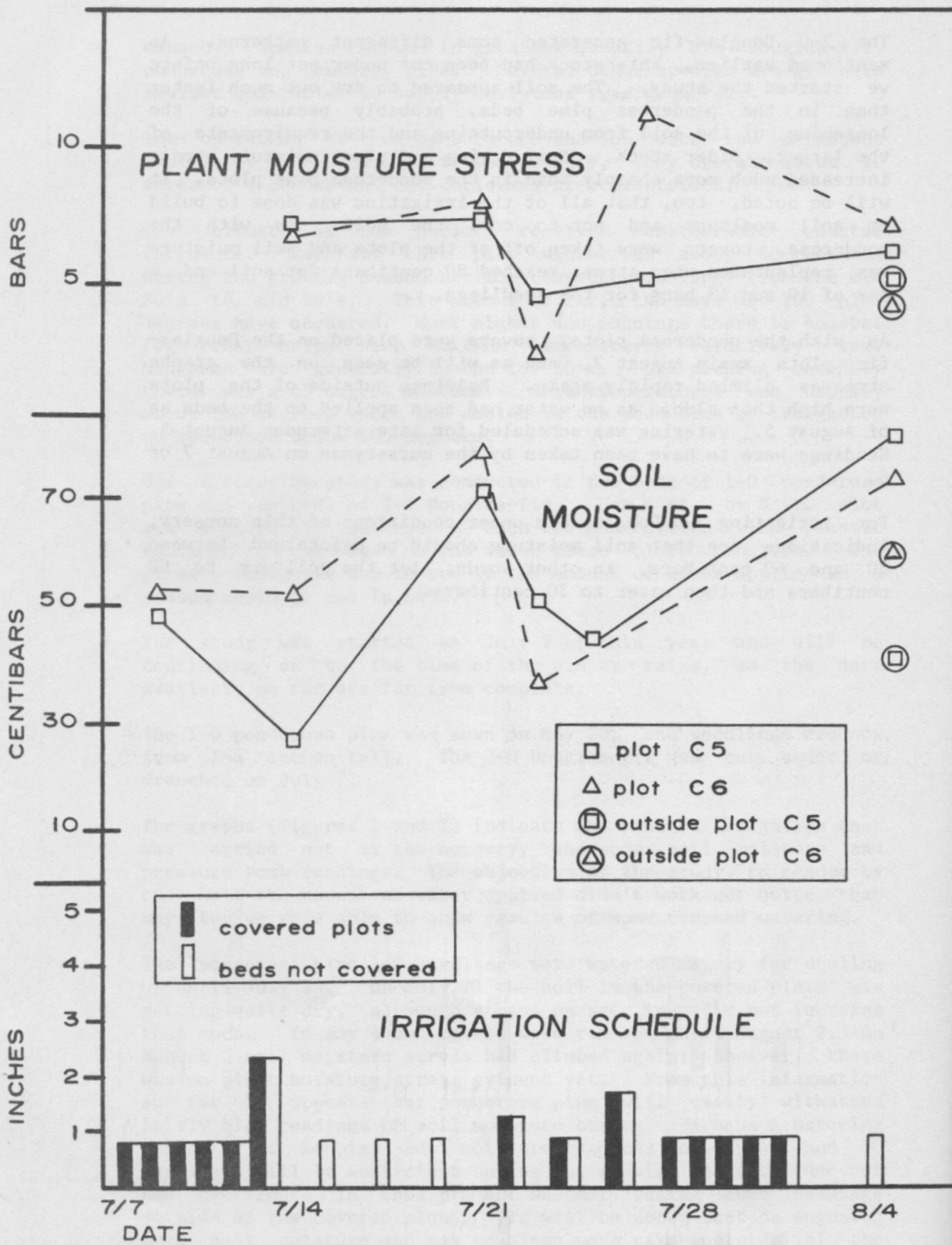


Fig.1 Ponderosa Pine 1-0

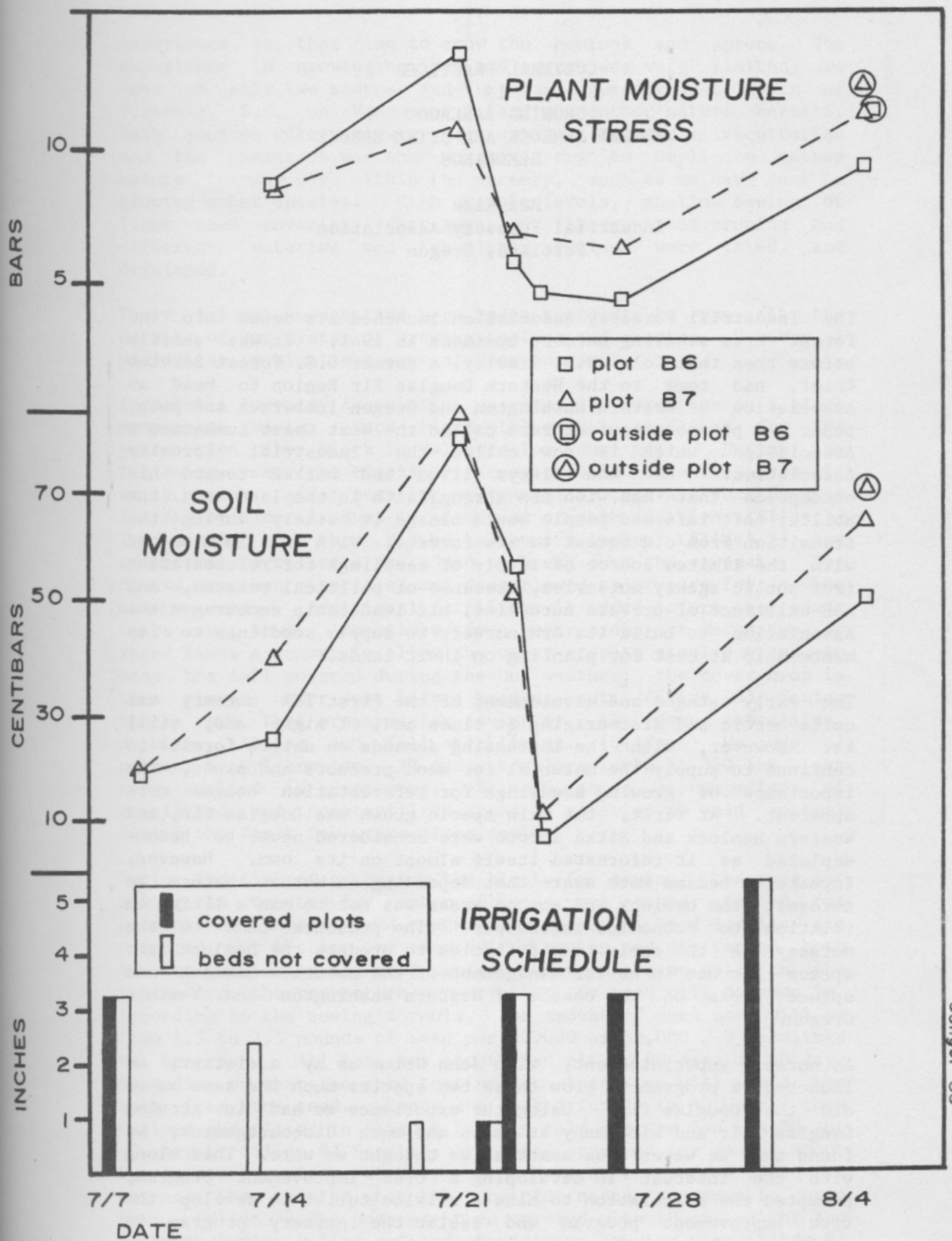


Fig. 2 Douglas Fir 2-0