Moisture Stress as a Requirement for Flowering of Coffee

Abstract. When coffee plants are watered at relatively short intervals, so as to maintain the water content of the soil at close to field capacity, the flower buds remain dormant and no fruits are formed. Irrigation or rain induces flowering only when preceded by a period of water shortage. Water stress is apparently essential to break the dormancy of coffee flower buds.

Coffee flower buds are formed only when the plants are subjected to short days (*1*, *2*). After differentiation, the buds grow rather slowly for about 2 months to a size of 6 to 8 mm and then stop growing for many weeks or months (*2*, *3*). Rain or irrigation is known to induce anthesis of many buds within 8 to 12 days, depending on temperature. Mes (*4*, *5*) postulated that it is predominantly water stress which keeps the flower buds dormant, and that any treatment which decreases the water tension inside the buds would release the inhibition. Rain and submergence of the buds in water are efficient ways of breaking dormancy (*4*, *6*), but according to Mes (*4*), soil irrigation is not as effective. However, Porteres (*7*) and Piringer and Borthwick (*2*) reported flowering of coffee after soil irrigation subsequent to a dry period.

In the desert coastal area of Peru, plant-water relationships may be readily studied because of the absence of rain. In a small coffee field at the Escuela Nacional de Agricultura, La Molina, near Lima, a group of 10-year-old plants belonging to the *Typica* variety, planted in 3- by 3-m plots, were subjected to two irrigation treatments (ten plants were treated in each case): (i) irrigation at weekly intervals; (ii) irrigation when soil moisture reached close to the wilting point at a depth of 1 ft. Flower bud differentiation in this area apparently takes place from July to September, and flowering may occur several times from October to May, frequently being rather poor, apparently because of inadequate water management in some years. The soil is a deep sandy loam with a field capacity of 18 percent and a wilting point of 9.5 percent. The treatments were applied from September 1958 to March 1959 and repeated from October 1959 to January 1960. Soil samples for moisture determination were taken at weekly intervals, before irrigation, at three sites in each plot. Water was supplied by surface irrigation in sufficient quantity to wet the soil to a depth of at least 2 ft.

With weekly irrigation, soil moisture content remained always above 15 percent (60 percent available), and not a single flower bud opened throughout the experiments. The "dry" plot received surface irrigation on 12 December 1958 and on 10 January, 18 February, and 11 December 1959, when soil moisture was, respectively, 9.7, 10.0, 9.5, and 9.4 percent. Flowering occurred 10 to 11 days after each irrigation and was particularly abundant after the irrigations of December 1958 and December 1959, when the number of unopened buds was highest. Figure 1 illustrates the difference between results with the two treatments.

Fig. 1. (Top) Flowering, 10 days after irrigation subsequent to a dry period. (Bottom) Dormant buds in plants receiving weekly irrigation. The pictures were taken 21 December 1959.

Contrary to the concept that water stress causes dormancy of coffee flower buds, these results indicate that water stress is apparently necessary to break bud dormancy. It is suggested that water stress removes a growth inhibitor responsible for bud dormancy. It apparently acts in a way comparable to chilling, whose influence on the dormancy of Temperate Zone plants is well known. One could perhaps speak of the "water stress requirement" as being just as important for coffee flowering as the "chilling requirement" is for many species in cold areas (*8*).

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References and Notes

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8. I wish to acknowledge the technical assistance of Manuel Bravo and Luis Vargas.

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