

borate being used. Manganese in the form of the sulphate was also supplied.

Table I gives the dry-weight yields of cultures with the various treatments used. The cultures were grown in triplicate and three series of cultures were grown at different times of the year. It will be noted that the yields of both tops and roots were increased by 1 part per million of boron; 2.5 parts per million of manganese, and a combination of boron 1 part per million and manganese 1 part per million. Greater amounts of these elements tended to depress growth. From figure 1 a visual comparison of the cultures may be obtained. It would therefore seem that the following two conclusions may be drawn.

1. When compared with certain grasses red clover, when grown in solution cultures, is much more sensitive to the absence of small amounts of boron and manganese.

2. Small amounts of boron and manganese when added to distilled water solutions tend to bring about increased root and top growth with red clover.—B. E. GILBERT AND F. R. PEMBER, *Rhode Island Agricultural Experiment Station*.

OBSERVATIONS ON THE RED COLOR OF THE BLOOD ORANGE

(WITH ONE FIGURE)

WHELDALE¹ makes the statement that anthocyanins are absent from citrus fruits "except in the red-fleshed variety, the so-called 'Blood Orange.'" She does not, however, give any experimental observations. The writer wishes to report the occurrence of the pigment in the fruit in crystalline form as well as to report some observations on the clear filtered juice.

The filtered juice has a pink to red color depending on the amount of pigment present. When acid (citric or hydrochloric) is added it turns to a deep pink or rose pink. The red pigment is not extracted from the juice by chloroform or ether. Ethyl acetate and amyl alcohol remove some of the red coloring matter. Sodium hydroxide changes the color to an emerald green. Lead carbonate and lead acetate produce a yellowish-green precipitate. The red color disappears when the juice is treated with zinc dust and hydrochloric acid but returns when the treated juice is allowed to stand.

Microscopic observation of the crushed juice sacs showed spherites or needle crystals of a deep red to reddish-brown color. One large group of crystals was blue-red, that is, about half way between a pure blue and a

¹ WHELDALE, M. The anthocyanin pigments of plants, footnote 1, p. 27, Cambridge, 1916.

pure red. A typical group of crystals is shown in the accompanying photomicrograph (fig. 1). Globules of red solution were also present, probably

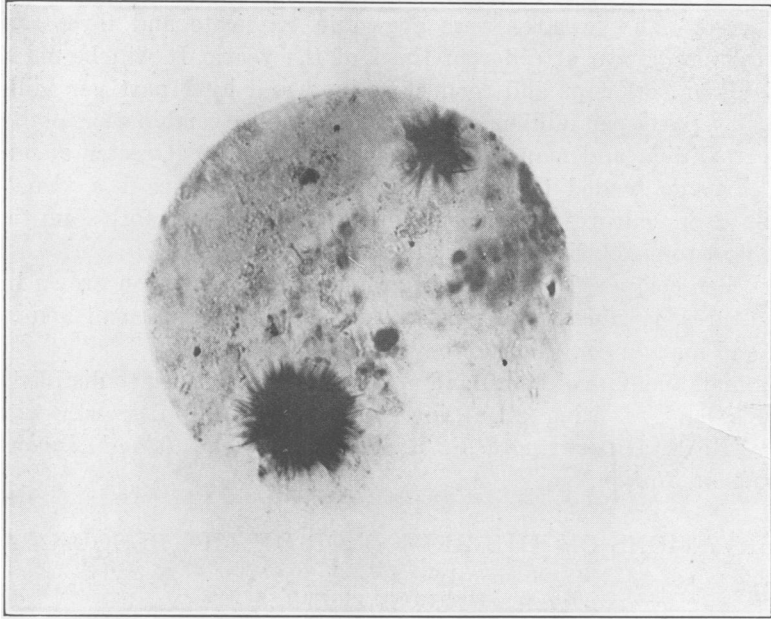


FIG. 1. Anthocyan crystals, $\times 110$.

held in separate cells of the juice sac. In one case long red needle-like crystals were found adjacent to a lump of deep red material. The red globules of solution and the crystalline material became clear blue when a drop of ammonium hydroxide was allowed to flow under the coverslip.—
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