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Fluorescence of Tissues in Avocado Fruit

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Investigations on development and physiological responses of avocado fruit generally have involved the fruit as a whole. Chemical analyses of the tissues and biochemical studies usually imply the utilization of the entire pericarp and do not consider specific tissues or locations within the fruit. Recent studies of more specific tissues and particular areas within the fruit structure indicate that physiological gradients exist which may provide explanations of normal and aberrant fruit development (4, 5). Physiological activity at given locations can account for some patterns of growth and of post-harvest responses (3). It appears that a more critical evaluation of specific tissues where biochemical reactions may occur or where chemical constituents may accumulate could lead to a better understanding and interpretation of fruit development and physiological behavior.

The literature on chemical and biochemical analysis of avocado fruits is fairly extensive, yet many questions remain unanswered regarding certain aspects of fruit development such as influence of environment on development of specific chemical constituents, particularly those related to the nutritional and dietary values of this fruit. Most of the biochemical constituents which have been reported in avocado are those determined by the conventional and accepted methods of analysis.

The fluorescence response of minerals and of organic compounds are properties which are well known for many substances in our environment. The use of ultraviolet, or black, light to detect such fluorescence in mineral displays is widely practiced in museums and by prospectors in the field. Fluorescence responses of materials of organic origin also provide a means to identify these specific substances hi plant materials. There are many organic materials produced in the pericarp tissues of avocado fruit which fluorescence with different colors when examined under ultraviolet light (1). Chlorogenic acids, cinnamic acid derivatives, and caffeic acid are readily detected by their fluorescence under ultraviolet light. Likewise phenolic compounds such as isoflavone have been recorded in avocado fruit. These analyses were made by extraction and purification of the materials from the entire mass of pericarp tissue. The specific location or concentration of the specific fluorescent molecules within the various fruit tissues was not determined in these investigations.

The fluorescence spectroscopy of chlorophyll in avocado fruit has been reported (2), which indicated a slight variation in fluorescence between the green layer adjacent to the peel and the innermost yellow tissue layer. These studies involved the extraction of the chlorophyll from the fruit tissues and determination of its properties outside of the fruit.

During the course of some systematic investigations on the sequential development and detection of the abnormal "stony" avocado fruit (3), it was considered possible that examination of the tissue under ultraviolet light might provide a means for tissue differentiation which might be useful for identification of abnormal tissue. Avocado fruits in various stages of development were cut transversely and examined in the dark directly under long and short range ultraviolet light using a UVGL-15 ultraviolet lamp. The freshly cut fruit tissue emitted a deep red color characteristic of chlorophyll in the outer peripheral tissue near the skin but no distinctive coloration of other tissues was evident. A record was made of each fruit for future reference by cutting the fruit longitudinally, placing the cut surface down on the notebook page and drawing around the fruit with a pencil. This provides a permanent and exact record of the size of the fruit. By mere chance one day, the ultraviolet light was turned on to the page where the fruit had been sketched. There appeared a vivid image outline of the Hass fruit in which the skin tissue fluoresced brilliantly in grey-white color and the fleshy pericarp wall was indicated with lesser intensity and with a red coloration. The cut seed appeared as a brilliant white color. These colors were not evident when the U.V. light was directed to the surface of the freshly cut fruit. The general technique of cutting the fruit tissue and exposing the cut surface on filter paper for various time periods allows soluble materials to be absorbed on the paper. These materials will then fluoresce, if they possess the property, as they spread onto the filter paper unmasked and unaffected by the other tissues in intact fruit.

The absorption of soluble substances on the filter paper probably does not indicate the presence of still other substances which may remain insoluble or which are located deep within the tissues. Fluorescence responses in this case represent only those materials which are readily absorbed by the filter paper.

The masking of the fluorescence responses in intact fruit tissues limits the use of ultraviolet light applied directly to freshly cut fruit. If the soluble materials are first extracted onto filter paper, the approximate distribution of any fluorescent substances can easily be determined.

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