BRIEF PAPERS

THE EFFECT OF ETHYLENE ON THE RESPIRATION OF BANANAS DURING RIPENING

(WITH ONE FIGURE)

In a paper from this laboratory presented at the Kansas City meeting of the American Association for the Advancement of Science, 1925, it was shown that ethylene doubled or trebled the production of carbon dioxide by celery for a short time after application, and that subsequently the rate fell off to a value below the normal respiratory rate at the same temperature.

Continuing these studies on the physiological influence of unsaturated hydrocarbons in ripening green fruits and vegetables, we have followed the rate of carbon dioxide production by bananas during ripening.

The fruit was placed in sealed glass containers provided with inlet and exit tubes. Suitable wash bottles were inserted to free the incoming air from CO₂ and to keep the air saturated with water vapor. The rate of carbon dioxide production was measured by means of the conductive cell which was described in the issue of PLANT PHYSIOLOGY for April, 1926. The whole train of apparatus was kept in a constant temperature bath at 25°C. The Adams arrangement for the conductive apparatus was used.

One or two bananas were usually used and the tests lasted from about five to fifteen hours. They were given one or more doses of ethylene carefully measured with a micro-gas burette. The dose was one part of ethylene to one thousand parts of air, since this was the concentration which had been found best suited to ripen bananas. The ethylene was allowed to act for fifteen to twenty minutes and then the aspiration was resumed. The air was aspirated from the container for fifteen to thirty minutes before passing it through the cell, to remove ethylene and the CO₂ which had been liberated during the period of treatment. Conductivity readings were taken every fifteen to thirty minutes thereafter for one or two hours, and if a second dose of ethylene was given to the same specimen, the procedure was repeated. The asterisks on the graph (fig. 1) indicate the points of treatment with ethylene. In all cases the rate of respiration expressed in milligrams of CO₂ per hour was doubled or trebled within a few minutes and then the rate fell off to a value lower than normal.

Bananas from the same bunch and run simultaneously with the treated bananas, although showing some fluctuation in rate, never showed the same
high rates or minima after the passing of the peaks of the curve that the treated bananas did.

Since the trend in all cases tried was the same, it was deemed best to show the graph of one typical treated banana and of one check run simultaneously under exactly the same conditions to illustrate the point rather than attempt to graph several runs on the same paper. This one is typical of many other curves, using Le Gros Michael variety and Cavendish bananas.

The method which was used allowed for the rapid determination of the rate of CO₂ production over a few minutes; consequently it was possible to follow the rapid rise and fall of the respiratory rate better than could be done by the method employed by Denney¹ on lemons. The high initial rate a few minutes after administration of the ethylene followed by a rapid fall to below normal may be due either to the increase of oxidation or to increase in the permeability of membranes allowing the diffusion of the CO₂ already present in the cells. The rise after the second dose of ethylene seems to indicate an increase in oxidation rate rather than permeability change. Evidently this stimulation wears off within less than an hour.

The rather rapid removal of ethylene by oxidation, as in the animal body after anaesthesia, offers an explanation for this. Continuous application of the ethylene seems necessary to continued increase in respiration.

Analyses made on treated and untreated bananas show that the treated bananas have one fifth to one fourth more sugar in them than the untreated bananas and that the starch content is proportionately decreased. The activity of the diastatic enzymes as well as the respiratory enzymes is increased by ethylene. Whether this is due to the cell permeability being increased, thereby making it easier for the enzymes and substrate to come together, and to facilitation of the intake of oxygen, or whether ethylene and propylene act as enzyme activators or actually increase the amount of the enzymes, we are now attempting to determine.—L. O. Regeimbali, G. A. Vacha, and R. B. Harvey, The University of Minnesota.

AN EFFECTIVE LABORATORY DRIER

(WITH ONE FIGURE)

A rather extended use of the phenol-disulphonic acid method for the determination of soil nitrates led the authors to experiment with various methods of speeding up the necessary step of evaporating aqueous extracts to dryness. The drier finally evolved (fig. 1) has proven fully satisfactory.

---

Fig. 1. Vertical section of laboratory drier. Description in text.
not only for that purpose, but also for the rapid drying of green plant tissues for analysis. The principle of operation will be obvious from the illustration. Its important advantages are (1) rapidity, (2) all parts of the drying chamber having very closely the same effectiveness. Details of size and construction may be varied to suit individual needs and preferences, but a brief description will be given of the model we have now in use.

A galvanized iron box, made by a local tinsmith, is lined with asbestos sheeting. The shelving and perforated partition shown at the right are made of asbestos slate (transite) held in place by light angle-irons and stove-bolts. A rapid air draft is provided by a 9-inch desk fan blowing through the funnel $F$, the path of the air being indicated by the arrows. The air passes across $H$, an electric hot-plate, into a narrow chamber at the right, from which it enters the drying chamber through 5 circular openings, 1.5 inches in diameter, opposite the space above each shelf. The second and third shelves do not run the full width of the drying chamber, but leave an air-gap at the left, bridged by light metal pieces (not shown in the figure). A set of air-holes at the top left are fitted with a damper $D$ for controlling the draft. The shelf-space is 14 inches square, with 4.5 inches between shelves. With the draft full open and the hot-plate turned to "high" (1,000 watts), the temperature of the drying chamber runs 61° to 63° C. Thermometers are inserted at $T$, $T''$ and $T'''$, to check the various shelves. It was found necessary to protect the bottom shelf with two extra layers of asbestos sheeting, also to cut down direct radiation by two layers of wire gauze $G$ over the hot-plate, to secure the same temperature on all shelves. The narrow chamber at the right is permanently closed in front by the wall of the box. The drying chamber is closed by a glass door, and the hot-plate by a piece of transite containing an opening for the switch. Over both the latter is fitted an outside door of galvanized iron.

Thermostatic control can be added at any time. It has not so far been necessary, as the drier has shown no tendency to vary more than a couple of degrees. In some laboratories it would no doubt be advisable to pass the entering current of air over a moisture absorbing agent. The low humidity of our Alberta atmosphere makes this unnecessary for ordinary purposes.—R. NEWTON AND W. H. COOK, University of Alberta.