EFFECT OF COLOR AND INTENSITY OF FLUORESCENT LIGHTS AND APPLICATION OF CHEMICALS AND WAXES ON CHLOROPHYLL DEVELOPMENT OF WHITE ROSE POTATOES

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After long exposure to fluorescent light, scrubbed White Rose potato tubers have been found to contain more chlorophyll than unscrubbed ones and greening was reduced by covering the potatoes with burlap to reduce light intensity (2).

Gull and Isenberg (1) studied the effects of light intensities, colored polyethylene bags, irradiation, and foliar sprays on chlorophyll formation in potato tubers. They found that greening at 25 foot-candles (ft-c) was less than that at 50 ft-c but at intensities above 50 ft-c no differences were observed. Potato tubers in red, yellow, blue and uncolored polyethylene bags exposed to 75 ft-c of fluorescent light for 60 hours contained about the same amount of chlorophyll as uncovered potatoes.

The data herein are from further investigations of chlorophyll formation in the White Rose tuber.

MATERIALS AND METHODS

The potatoes used in all experiments were California-grown U. S. No. 1 White Rose, scrubbed with commercial washing machinery in packing sheds in various production areas. The tubers were packed in light-proof boxes and immediately shipped to Davis, California, for studies.

The potatoes were exposed continuously to 40-watt cool white standard fluorescent lights unless otherwise indicated. Light intensity, in foot candles (ft-c), was measured with a General Electric Foot-Candle Meter.

To evaluate the effects of light quality on greening, the cool white lights were compared with General Electric 40-watt warm white deluxe, daylight, blue, green, gold, pink, and red fluorescent lights. In addition, light from four frosted 75-watt incandescent lamps was included. The experiment was conducted twice with different lots of tubers, and the results of the chlorophyll analyses are reported as percent of the control.

Colored polyethylene films were supplied by several commercial fabricators of polyethylene bags. The light-transmission qualities of these and colored cellophane were compared by spectrophotometry. Their ability to retard tuber greening on exposure to light was also investigated.

Different light intensities were obtained by spirally wrapping a tape of aluminum foil around the fluorescent tubes. A stepwise platform was constructed to obtain different light intensities under any one set of lights. Two platforms were put in a constant-temperature room (70°F), with baffles so that the lights from one did not interfere with the other. The light intensities obtained ranged from 12 to 133 ft-c. Two replications of 15 tubers each were tested at each light intensity.

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Applied Chemicals

The formulations used, herein designated wax A and wax B, were obtained from commercial firms. After the tubers were immersed in cold water, the wax was applied with a small cellulose sponge dampened slightly with wax. Sufficient wax was applied so that a thin film remained on the surface. The tubers were allowed to air-dry before exposure to light. These waxing experiments lasted up to 96 hours of light exposure and even in this short period internal breakdown from anaerobic respiration was often observed. For this reason waxing does not appear to be an acceptable process.

Another lot was dipped in a solution of ethylene diamine tetraacetic acid (approximately 0.5 per cent EDTA). EDTA as foliar spray on potatoes has been found effective in reducing greening (1). Trans-cinnamic acid has been suggested as being effective in reducing greening. Tubers were dipped in a saturated solution of this chemical for 5 minutes and air-dried. A light absorbing chemical supplied by the Dow Chemical Company was tried in the search for another substance for reducing greening. Tubers were dipped in a 1 per cent solution of light absorber (Dibenzoyl-resorcinol) and in combinations with wax B and trans-cinnamic acid. Four replications of each of the treatments, 15 to 20 tubers per replication, were exposed to 90 ft-c of light for 48 hours and the tissue analyzed for chlorophyll content by the method below.

Chlorophyll Analysis

Tissue sampling for chlorophyll consisted of removing 10 to 15 cores from the exposed half of an individual tuber with a cork borer 1 cm in diameter. Discs about 3 mm thick were cut from the periderm side of the cores with an apparatus similar to one described by Larsen (3). The potatoes were sampled from both the apical and stem ends. It had been found that the opposite ends of the White Rose potato contain significantly different amounts of chlorophyll (2). Samples were taken from tissue free of eyes, and the discs were freeze-dried. The tissue was then ground in a Wiley Mill to pass through a 20-mesh screen. Chlorophyll was determined as previously described (2). The results were expressed as micrograms (µg) chlorophyll per 100 square cm area.

With scrubbed White Rose potatoes, a faint green is visually detectable at approximately 25µg of chlorophyll per 100 cm². Tubers are definitely green at 50 µg per 100 cm². Potatoes with 100 µg or more per 100 cm² are objectionably green, and may be considered unmarketable.

Results and Discussion

Quality and Intensity of Lights

Colored Fluorescent Lights: Since most of the newer supermarkets are illuminated with fluorescent lights, various colored fluorescent lights were used to study the effects of light quality. Chlorophyll content of tubers exposed to the different colored lights was compared to that under the cool white standard (Table 1). The blue, and daylight fluorescent light caused more greening than the cool white standard under 75 ft-c of light. Tubers under cool white deluxe had the same chlorophyll content as the control, but potatoes under warm white standard and deluxe, which have