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Application of the Polaroid-Land Process to Radiographic Inspection of Wheat

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COMMUNICATION TO THE EDITOR

Application of the Polaroid-Land Process to Radiographic Inspection of Wheat[1]

DEAR SIR:

At a time when the technique of X-ray inspection of grains for internal insect infestation, announced almost two years ago[2], appears to have gained considerable currency in industries handling and processing grain[3], there exists the general feeling that these industries would be more receptive to any technique which would even further simplify and expedite the radiographic inspection process. To this end Kansas State College and the Picker X-Ray Corporation have engaged in a cooperative study relating to the application of the Picker-Polaroid photographic process to the determination of internal infestation in grain. This process is based on the principle of the Polaroid-Land camera and requires no darkroom or processing of film in solutions. Approximately one to two minutes after an exposure is made, a positive print can be removed from the processing box in suitable condition for examination.

For normal use in medical radiography the packet of photographic material supplied consists of a sheet with an X-ray sensitive emulsion combined with a pod of developing chemicals, both contained in a light-tight black paper envelope to which is attached a sheet of specially prepared paper on which the positive image finally appears. The film packet is loaded into a special cassette (film holder) and the X-ray exposure is made in the usual way. Processing the exposed film is accomplished in a small automatic unit which can be located beside the X-ray machine. No darkroom or solution tanks are required.

In our application it was necessary to minimize the amount of radiation-absorbing material in the path of the X-ray beam. With the low excitation voltages required for the production of a suitable radiographic image of wheat, as little as 1/32″ of lucite absorbs out an appreciable amount of the beam intensity and 3/32″ of lucite almost completely absorbs the soft radiation. Consequently, we exposed the sensitive emulsion without using any cassette, by simply placing the packet in its black paper envelope on the exposure table and sprinkling a layer of grain on it. A lucite step-wedge made from 1/32″ thick

[1] Contribution No. 222 Department of Flour and Feed Milling Industries, and Contribution No. 28 Department of Physics, Kansas Agricultural Experiment Station, Manhattan, Kansas.

[2] Milner, M., Lee, M. R. and Katz, R. Application of X-ray technique to the detection of internal insect infestation of grain. J. Econ. Entomol. 43:933-935 (1950).

[3] Dubois, D. Use of the X-ray in milling wheat selection. Milling Production 17, No. 9, pp. 1, 22 (1952).

lucite sheets cemented together also was placed on the film in order to better judge the contrast of any exposure made. Usable radiographs were obtained with 90 seconds of exposure at 16 kilovolts while exposures which we believe are as contrasty as could be used on a paper print were obtained with an exposure of 20 minutes at 13 kilovolts. The beryllium window X-ray tube had a molybdenum target and was operated at about 12 milliamperes in each case. Use of a tungsten target tube and the higher currents of which such a tube is capable, would materially decrease exposure time. Figures 1 and 2 representing different exposures, are reproductions of Polaroid radiographs of infested wheat taken in the manner indicated.

It may be stressed that the Polaroid process provides a positive print rather than the negative reproduction given by radiographs made with ordinary X-ray film. The reproduction with the Polaroid materials, while not providing the great detail appearing in a properly prepared radiograph, appears nevertheless to be entirely satisfactory for the inspection of grain for gross internal insect infestation.

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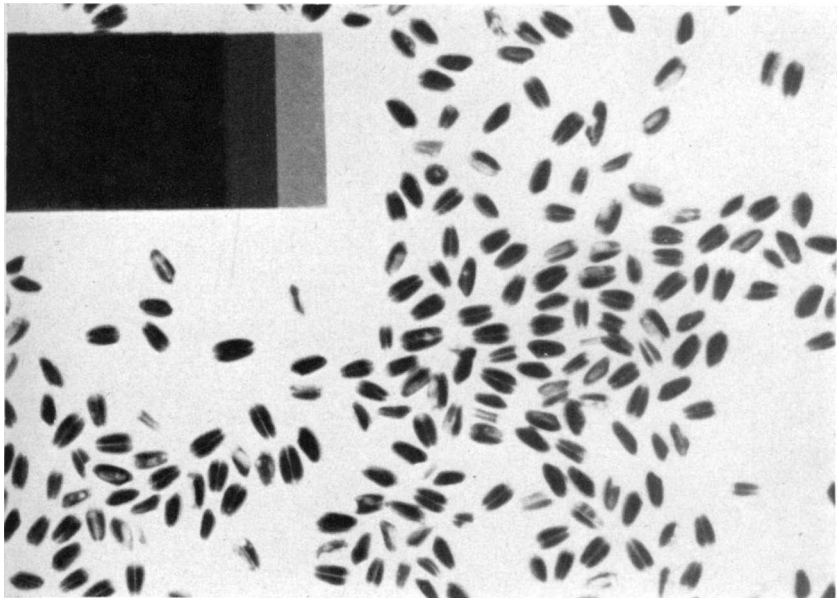

Fig. 1. Polaroid process radiograph of wheat infested with rice weevil, exposed for 90 seconds at 16 kilovolts and 12 milliamperes (Low contrast exposure), molybdenum target X-ray tube.

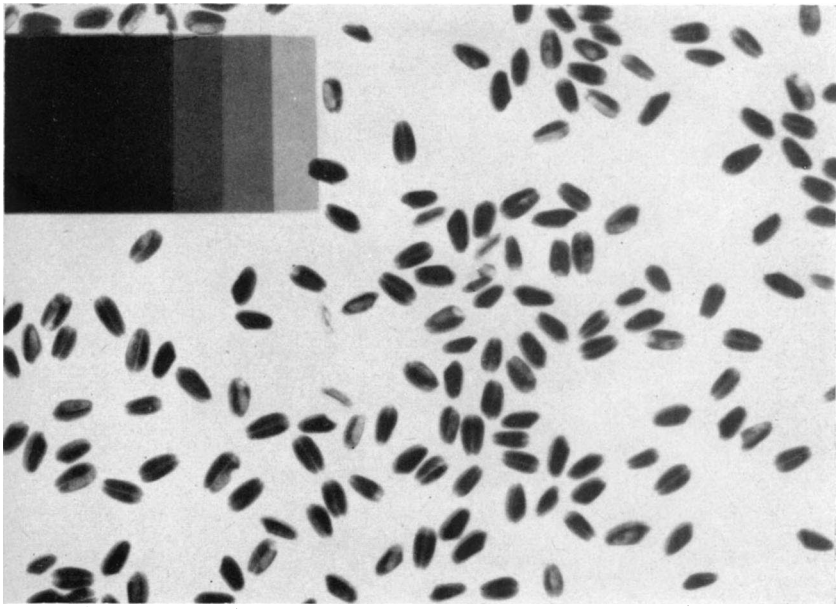

Fig. 2. High contrast exposure, similar to Fig. 1 but with 20 minutes exposure at 13 kilovolts and 12 milliamperes.