Note on Mineral Content and Location in Pearl Millet

E. VARRIANO-MARSTON and R. C. HOSENEY

Because pearl millet (*Pennisetum americanum* (L.) Leeke) is an important food crop in many developing countries in the semiarid tropics, many investigators are studying its nutrient composition. Although some work has been reported on the mineral content of Indian and African cultivars (Carr 1961; Deosthale et al. 1971; Goswami et al. 1969a, 1969b, 1970a, 1970b; Shah and Mehta 1959), only one article provides information on the mineral constituents (Ca, P) of pearl millet cultivars grown in the United States (Burton et al. 1972). The following paper reports on the mineral content of four bulk populations and 17 lines of pearl millet grown in Kansas. In addition, the location of minerals in the grain was investigated.

MATERIALS AND METHODS

We studied seventeen HMP 550 S lines (Tift 23 DB$_1$/2 *PI1185642) of pearl millet and four bulk populations: HMP 550, a combination of 110 S$_1$ lines; HMP 1700 (PI263540/Tift 23 DB$_1$/2/Tift 239 DB$_2$/2 *Serere 3A); RMP II(S)Cl (parentage from Serere 3A, Serere 17, and Tift 239 DB$_2$/); and Serere 3A, developed by Serere Experiment Station, Uganda, Africa. The method of Purdy et al. (1968) was used to describe pedigrees of the millet samples; HMP and RMP refer to Hays millet population and regional millet population, respectively.

Millet samples were not dehulled before mineral analysis. Mois-
Duplicate mineral analyses were done on each sample.

Millet kernels were prepared for X-ray microanalysis by fracturing grains longitudinally with a razor blade, mounting the halves on stubs with colloidal graphite, and coating with carbon. X-ray spectra were obtained with a Tracor Northern TN-1710 X-ray energy dispersive analyzer attached to a Cambridge Stereoscan scanning electron microscope. Area scans were made on the germ,
covering layers (including aleurone), and hard and soft endosperm. A counting time of 100 sec was used to obtain optimum peak-to-background ratios.

**RESULTS AND DISCUSSION**

Protein, moisture, and ash contents of millet samples are presented in Table I. Protein contents ranged from 11.1 to 14.7%, ash contents from 1.4 to 1.9%. Both are within the ranges reported by Goswami et al. (1969a, 1969b, 1970a, 1970b) for pearl millets grown in India.

Mineral contents of the various millet samples are shown in Table II. Contents of individual mineral elements vary somewhat among populations and Si lines, which may be a function of agronomic conditions as well as of genetic background. In general, the data indicate that 1) P, K, and Mg are the major mineral constituents in the grain; 2) pearl millet is comparable to wheat in Fe and Zn contents; 3) the Ca content of our samples was lower than that reported by other authors (Goswami et al. 1969a, 1969b, 1970a, 1970b); and 4) the P content in millet is more than twice that reported for wheat (Ziegler and Greer 1971). Millet’s high P content may be an important factor in determining the total nutritional value of this grain, particularly if P is present in the grain as phytin, which may reduce the absorption of trace minerals from the gastrointestinal tract. Phytin phosphorus has been reported to constitute from 33 to 90% of the total phosphorus in cereal grains (Hamdy 1971). Studies characterizing the major sources of phosphorus in pearl millet would be valuable.

The locations of minerals in pearl millet kernels were determined by X-ray energy dispersive analysis. High levels of Si and K were present in the covering layers (including the aleurone), and a major portion of the phosphorus was located in the germ (Fig. 1). High levels of iron were found in both germ and covering layers. Low mineral concentrations were observed in the hard and soft endosperms; the predominant minerals detected in those areas were S, K, and Fe. The greater concentration of minerals in the covering layers and the germ than in the endosperm portions is typical of most cereal grains (MacMasters et al. 1971).

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**LITERATURE CITED**


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