SEPARATION OF LIVING AND DEAD CORN (Zea mays) KERNELS WITHOUT GERMINATION

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The improvement of seed quality by processing methods is a standard procedure in modern seed technology. The present paper presents data to indicate that the germination of lots of injured seed corn could be materially improved by the use of a somewhat modified version of the "electric eye" bean sorter, a sophisticated electronic device that is routinely used in removing discolored beans from commercial and seed beans. No papers dealing with this specific subject were found. It is well known, however, that seeds with a relatively high moisture content are more readily injured by freezing than are drier seeds, that damp tissues conduct electricity better than do dried ones, and that tissues that have been injured by freezing conduct electricity better than do similar undamaged ones.

Two types of kernels were used: (1) Nine commercial seed lots, deteriorated by age or abuse, and (2) seed corn of four varieties, selected from the field, and completely free from freezing or other damage. Four ears of each variety were selected to represent the extreme range of moisture content.

Samples, if dry, were soaked in water for several hours, and frozen to obtain various degrees of injury. The electrical system was made up of 4 dry cells (6 volts) connected in series with a milliammeter, a push-button contact and spring-activated electrodes between which each individual kernel was placed. After the milliammeter was read, the kernel was placed on a blotter on a numbered area indicating its conductance to the nearest 0.5 ma. Then the blotter with the sorted seeds was placed in the germinator.

Results

Table 1 shows the results with two representative lots of deteriorated commercial seed corn, alone and in mixture with a portion of frozen kernels. Practically without exception, the electrical sorting enabled a separation into 2 lots, 1 of which had a germination of 90% or better. The success of the sorting was largely dependent on soaking sufficiently (up to about 30% moisture) so that a range of conductance up to about 20 ma. was obtained; contrary, moisture contents were so low that the conductance was 8 or 10 ma., certain dead kernels soaked insufficiently were judged by conductance to be alive. In general, if the cut-off point was one and one-half times as many kernels were thought to be dead, from germination test, as with conductances less than the cut-off point had a percentage germination of 90% or better. More precise grading for kernel thickness added little to the efficacy of the sorting method.

The freshly harvested seeds were electrically sorted before and after drying. In preliminary trials, from each of the 4 varieties, it was noted that the unfrozen kernels from the wetter ears conducted electricity better than did those of the drier ears, and that, after freezing, wet kernels showed a greater increase in conductivity and a greater degree of injury than did the drier kernels. This was true both within and between varieties. In a second trial, 10 kernels were taken from each of the 4 ears in the 2 medium-moisture varieties. These were frozen at about –4 °C. for 24 hr. and germination readings were taken in between. In a third test, all living kernels were found in groups of 4 ma. and less. The highest conductance was 11 ma. and all living kernels were found with conductances less than the cut-off point had a percentage germination of 90% or better. More precise grading for kernel thickness added little to the efficacy of the sorting method.

Table 1. Numbers of seeds found dead by germination and indicated as dead by conductance in 2 seed lots and their mixtures with frozen kernels. Conductances were 1 to 25 ma. and the cut-off point was 8 ma. Each lot or mixture was tested in triplicate.

Table 2. Conductances before and after freezing and grading for kernel thickness added little to the efficacy of the sorting method.

Table 3. Number of kernels with various conductances that were alive after freezing. The numbers, as 47–1, refer to the percentage of kernels alive after freezing.