Use of Controlled Low Temperature in Evaluating the Cold Hardiness of Inbred and Hybrid Maize

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The ability of a corn seed to germinate and produce a good corn plant in a cold wet soil may at times mean a successful crop instead of a failure. Consequently, there has been considerable work attempting to make corn lines more cold hardy. In many instances the lines of corn being tested have been planted in the field just as early as it is possible to work the soil in the spring.

Planting dates in Connecticut over the past 10 years have varied from late March to late April, at least a month and sometimes two months before the regular planting season. Growers of early sweet corn may plant as early as late April. To them cold hardiness is extremely important as it may mean a good or a very poor stand. The old Spancross C13.4 has proved very cold hardy and has been used in these early plantings. In recent years sweet corn has been grown in increasing amounts in southern England. Since there is considerable cold, wet weather after the corn is planted, it is essential to use cold hardy strains.

Since the climatic conditions vary so much from one year to another we wondered whether controlled growing conditions might not give more reliable data and a more sensitive test for cold resistance. The following experiment was designed to determine whether a cold room test could be used to replace the customary early spring sowings and whether it could offer a more controlled stringent method for selecting hardier corn lines with the ability to germinate under cold conditions.

When discussing the origin and importance of sweet corn as an Indian food plant in the United States, Erwin (2) has recorded that sweet corn tends, under the favorable environment of the corn belt, to revert to field corn type becoming more starchy or forming starch caps. He also recognized that sweet corn is inherently a plant of less vigor and stamina than field corn, the seed being more likely to decay if planted too early, while in the autumn it is slower in curing than the latter and so more subject to injury from freezing. Haber (4) also concluded that sweet corn mutations are less likely to survive than field corn in the struggle for existence under the rugged environment of the corn belt, indicating that it has often been stated.

Material and Methods

Seventeen lines of sweet corn, mostly inbreds, field corn, inbreds and hybrids, were available for the cold room test and the early spring sowing in the field. For the cold room, seeds of each line was sown in flats containing soil taken from a field previously thus likely to contain supplies of the pathogens which attack germinating seeds under the poor conditions. The flats were placed in a room maintained at 50°F and kept moist by watering when necessary. At the end of 32 days they were placed in a warm greenhouse, the final germination being estimated by counting the number of emerged plumules of each strain. The experiment was repeated with a different randomization of strains so that two estimates of germination were available.

The seeds for the outside test were sown on April 10, 1947, at the Mount Carmel farm, the first date when sowing was possible. The final germination of the seedlings in the field was determined.

In the cold room an occasional seedling germinated all emerged only after transfer to a warm greenhouse.

Experimental Results

Resistance to Cold Treatment

The estimation of percentage germination in the percentage of killed seeds, so that instead of the mean percentage germination, estimates of the final counts for each cold test and multiplication by two, the angular transformation was used, the scale being derived as the mean angular value as there was no replication.

Table 1 gives the estimates of sweet corn germination for cold room and field. For each variety it gives the percentage germination for the cold room test and the second line the values for the field test. Table 2 gives the similar results for inbred and hybrid corn.

Figs. 1 and 2 give the scatter diagrams of the mean percentage germination, estimated by pooling the percentages in each test. For the field results, the percentage of killed seeds, so that instead of taking the angular value as there was no replication.