Prevention of Field Deterioration of Cottonseed by an Impermeable Seedcoat

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FIELD deterioration of cottonseed is directly related to pre-harvest moisture conditions. Several workers, including Simpson and Stone (6) and O'Kelly and Hull (5), have established the relation between rainfall or high humidity and loss of planting and milling quality of cottonseed. Recently it was suggested that an impermeable seedcoat might be valuable in reducing field deterioration of cottonseed (2).

A heritable impermeable seedcoat is a common characteristic of wild species and unimproved forms of cultivated Gossypium species. It is likely requisite for survival of wild forms. Stevens (7) suggested that an impermeable seedcoat could have been important in the movement of the genus across ocean barriers. The trait is of occasional occurrence in commercial upland cottons (G. hirsutum L.) even though cultural methods apply selection against slow-germinating seed. It is a problem in Pima S-1, a western commercial variety of G. barbadense L. Walhood (8) developed a hot-water treatment which renders Pima cottonseed water permeable. The treatment is also effective on seed of other strains.

The value of an impermeable seedcoat in prevention of high humidity-induced cottonseed deterioration in storage was previously reported (4). This paper presents results of research on the value of an impermeable seedcoat in preventing field deterioration of cottonseed.

MATERIALS AND METHODS

The strains of G. hirsutum L. used in these studies were M-8, a doubled haploid from Deltapine, and 16B-7, a selection of Hopi-upland genetic constitution. M-8 normally produces water-permeable seeds, and 16B-7 produces primarily impermeable seeds. Fruiting habit and boll maturity period are similar for the two strains. Prior to planting, all seeds were given a hot-water treatment consisting of a 2-minute immersion in water at 85°F. This treatment was shown to be effective in preventing field deterioration of cottonseed (2).

Results of research on the value of an impermeable seedcoat in preventing field deterioration of cottonseed. In the 1961-62 test the entire plot was harvested for quality studies. The 1962-63 test had a high incidence of boll-rot in both M-8 and 16B-7 resulting from rank growth and high humidity during the boll-maturity period. Boll-rot materially reduced seed quality of both M-8 and 16B-7. Two harvests were made from each plot to determine the influence of boll-rot on seed quality and eliminate it as a factor. One was composed of all bolls from a section of row, and the other of only bolls with no evidence of previous rot.

After each harvest the seed cotton was immediately dried at 40-45°F for 48 hours and roller ginned. Germination tests were made on 100 chipped seeds from each of the 4 field replications. The germination tests involved placing 25 seeds between 2 germination papers, wetting with 60 ml of distilled water, and rolling with a waxed-paper outer covering. Thus, each 100-seed sample required 4 rolls. Germination counts of normal seedlings were taken after 3 days at 31°C.

Milling quality of the seeds was estimated by determining the free fatty acid content. Oil was hydraulically expelled and free fatty acid content determined by titration with NaOH solution following a modification of A.O.A.C. method 26.30 described by Christiansen and Moore (3).

Studies were made to exclude the possibility that factors other than an impermeable seedcoat are implicated in the observed quality preservation. Samples of seed were harvested on March 28, 1962, from the 1961 study. Germination percentage of chipped seed was determined for the M-8 and 16B-7 in the manner previously described. Seed were soaked in water 4 days to determine the impermeable seed remaining after approximately 6 months of field exposure. The seed which imbibed water were removed each day and tested for germination. Impermeable seed remaining after four days soaking were chipped and tested for germination.

Field moisture and temperature conditions are important in seed deterioration. The 1962 harvest season was very dry from mid-September through October. No appreciable rainfall occurred while temperatures were sufficiently high to support rapid seed deterioration. The 1962 harvest season was moderately wet during the peak boll-maturity period in September with 8 days of rainfall. Ten days with rainfall occurred in October. Temperature maxima of 85-95°F were common. Thus, during the boll-maturity period in 1962 micro-environmental conditions were conducive to boll roting and seed deterioration.

RESULTS

Viability was high in both M-8 and 16B-7 seed from the November 1961 harvest (Table 1). Only a slight loss of germination had occurred in M-8 by December and no loss was noted for 16B-7. A considerable loss in germination of M-8 occurred by January. The 16B-7 seed quality remained high. The germination data from the 1962-63 test reflect the adverse weather conditions prevalent during the boll opening period in September and October. The M-8 seed from entire-plant harvests in November germi-