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ABSORPTION AND LOSS OF MOISTURE IN COTTON BOLLS PREVIOUSLY TREATED WITH DEFOLIANTS, ADJUVANTS, AND DEFOLIANT-ADJUVANT MIXTURES[1]

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THE proper use of chemical defoliants preparatory to harvest is recognized as an advantageous practice throughout the Cotton Belt. For better efficiency, growers usually attempt to begin the harvest as soon as practical following maximum defoliation. Rain or heavy dew following defoliation, however, usually necessitates a delay in harvesting. The recently accepted commercial practice of using adjuvants with chemical defoliants to facilitate defoliation has raised a question regarding the rates of moisture absorption by cotton and the drying of cotton bolls when rain or heavy dew follows application of defoliant-adjuvant mixtures. Evidence to date indicates that adjuvants make droplet size more uniform, aid the penetration of other substances into plant cells, increase the spreading of droplets over the leaf surface, and tend to "stick" the defoliant material to the leaf (1). Usually most bolls are open when harvest-aid chemicals are applied to cotton, and some of the defoliant solution is unavoidably deposited on the open bolls. Since intermittent rainfall often proves the most costly impediment to harvest, the use of any material which might cause bolls to absorb more moisture and/or ultimately delay drying would not be desirable.

Earlier work (3) demonstrated that relative humidity affects the moisture content of seed cotton. And more recent experiments (2) showed the relative humidity to be lower in defoliated than in undefoliated fields of cotton. However, little information is presently available relative to the drying of cotton previously treated with defoliant-adjuvant mixtures. A number of experiments, therefore, were conducted to investigate the rates of moisture absorption by cotton and the drying of cotton previously treated with defoliants, adjuvants, and defoliant-adjuvant mixtures.

Experimental Procedure

Cotton bolls collected from the varieties Plains and Deltapine 15 (*Gossypium hirsutum* L.) were utilized in 15 separate experiments at the University of Arkansas Agricultural Experiment Station, Fayetteville, Ark., in 1960 and 1961. Two defoliants and two adjuvant formulations, representative materials commonly used in commercial practice, were utilized in the experiments as follows: The defoliant Shed-A-Leaf "L" (sodium chlorate 18.5% with sodium metaborate) was used at the recommended rate of 4 pounds per 10 gallons of water per acre, and the defoliant DEF (s,s,s-tributyl phosphorotrithioate 70.5%) was used at the recommended rate of 1½ pints per 10 gallons of water per acre. The adjuvants Colloidal X-77 (alkylarylpolyoxyethylene glycols, free fatty acids, and isoproponal) and Spreader Sticker (sodium sulfates of mixed long-chain alcohol fatty acid esters and diethylene glycol abietate) were used at a rate of 2 quarts per 100 gallons of defoliant solution in 14 of the experiments; in one experiment, adjuvants were used at rates of 2, 4, 6, and 8 quarts per 100 gallons of defoliant solution.

The chemical treatments were as follows: (a) defoliant alone, (b) adjuvant alone, (c) defoliant-adjuvant mixture, and (d) no treatment (check). The time lapse from chemical treatment to moisture treatment varied from 1 hour to 7 days. After chemical treatment, bolls (36 bolls per sample) were moistened and air-dried in the laboratory. Bolls were arranged in a randomized block design on elevated, grided hardware cloth; replications numbered 3 or 4 in each experiment. In experiments concerned with both moisture absorption and drying, bolls were moistened with a fine, water spray at 30-minute intervals for 2½ hours and then allowed to air dry. In experiments concerned with drying alone, bolls were moistened with distilled water in amounts required to vary the moisture content up to a percent moisture equivalent to saturation. Bolls were weighed at 15-minute intervals throughout each of the experiments.

Results and Discussion

A statistical analysis of data from each experiment showed no significant differences among treatments; i.e., neither moisture absorption, rate of moisture loss, nor the time of ultimate drying of seed cotton was affected by previous treatments with defoliants, adjuvants, or defoliant-adjuvant mixtures. Also, the lapse in time from chemical treatment to moisture application had no significant effect on moisture absorption by cotton bolls or moisture loss from cotton bolls.

Tabular data have been omitted from this paper since statistical analyses of the data from all experiments showed no significant differences among treatments; C.V. range = 0.9 to 1.1%. A composite of data from the experiments, however, is given in Figure 1. The expectation curves A, B, and C represent a composite of eight separate experiments in which a predetermined amount of moisture was applied to chemically untreated bolls (checks) and to bolls

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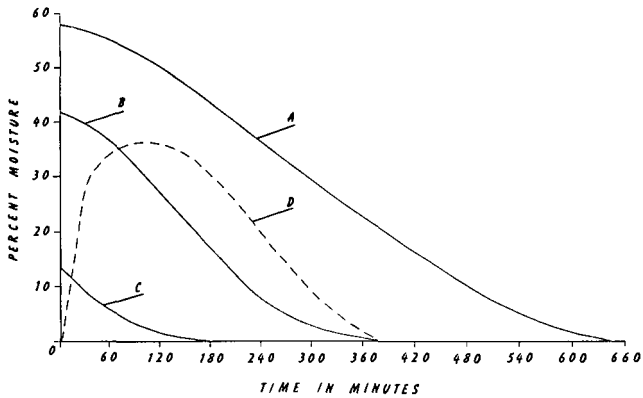

Figure 1—A composite of treatment means showing moisture absorption and loss in cotton bolls.

previously treated with defoliants, adjuvants, and defoliant-adjuvant mixtures; treatment means are combined in the expectation curves since there were no significant differences with respect to drying rates of untreated bolls and bolls previously treated with defoliants, adjuvants, or defoliant-adjuvant mixtures. The mean time required for air drying bolls that were saturated (57% of total weight) was 645 minutes, curve A. Bolls that received less moisture, 42% of total weight (curve B) and 13.5% of total weight (curve C), dried in a shorter time; i.e., means of 375 and 180 minutes, respectively, were required for the bolls to dry to their original weight. During the course of the eight experiments concerned primarily with moisture loss, the temperature was 78± 4° F. and the relative humidity 36± 4%. Expectation curve D depicts a composite of data from seven experiments concerned with both moisture absorption and moisture loss. In the seven experiments, data relative to moisture absorption and loss showed no significant differences among treatments; treatment means are combined in curve D. In the experiments depicted by curve D, the mean temperature and relative humidity were 75° and 52%, respectively.

The results of this study indicate that bolls moistened by rainfall or heavy dew in defoliated fields of cotton would not be affected with respect to moisture gain or loss as a result of previous treatment with defoliants or defoliant-adjuvant mixtures at recommended rates of application. Excessive rates of adjuvants also had no effect on moisture loss from cotton bolls. For example, in one experiment adjuvants were used at a rate up to 8 quarts per 100 gallons of defoliant solution, which is 4 to 5 times the recommended rate for adjuvant materials, without effect on the drying rate of wet cotton bolls.

The increasing use of mechanical harvesters indicates the continued need for harvest-aid chemicals to facilitate harvesting. The results of this study indicate that at recommended rates of application, defoliants or defoliant-adjuvant mixtures per se do not contribute to a delay in harvest if rainfall or heavy dew follows defoliation.

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