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A Method for Evaluating Storm-Damaged Cotton for Extension County Agents and Specialists

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Abstract
Extension county agents and specialists are often asked to provide unbiased crop damage assessments when storms occur. There is generally no published methodology on which to base damage assessments. The objectives of the project described here were to (a) provide an unbiased database to producers and crop insurance representatives and (b) develop an unbiased, in-field method for damage evaluations for cotton. This method proved to be effective in allowing Extension personnel to monitor crop damage over time as a result of the storm. It provided an unbiased database for use by Extension and USDA workers, producers, and crop insurance personnel.

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Introduction

Each year, severe storms with high winds, heavy rain, and hail damage farms and crops. Producers in the coastal states of the southern United States Cotton Belt suffer losses due to hurricanes that occur from July through October. The damage caused by severe storms can slow cotton development, cause boll shedding, and induce "cutout" (end of the flowering period) (Abeles, 1973; Beyer, Jr., 1975; Ehlig & LeMert, 1973; Guinn, 1976a; Guinn, 1976b; Patterson et al., 1978; Reddy et al., 1992; Suttle & Hultstrand, 1991).

Extension agents and specialists are often asked to help in evaluating the effects of storms on various crops within their county or state. While hurricanes can cause major damage to homes and farms, there are no published methods to evaluate their effect on field crops.

Hurricane Erin made landfall near Pensacola, Florida, in August 1995, and moved across Alabama through an area with several thousand hectares of cotton. Wind speed at the time of landfall was greater than 153 k hr^{-1} (95 miles hr^{-1}). Rainfall associated with the storm was 15 centimeters, with a total of 24 centimeters for the month of August. Bolls in contact with the soil surface and the reduction in sunlight penetration and air movement between the rows increased the likelihood for boll rot.

Producers were concerned about the potential for increased costs of insect control and defoliation due to the necessity for aerial pesticide application and decreased yield potential. Extension personnel were asked to aid producers with evaluations of crop damage in the southwest cotton growing area of Alabama.

Purpose of Study

The purpose of the study was to develop an in-field method for evaluating the effect of the mid-season storm on cotton. Specific objectives were to:

- Provide an unbiased data base to Extension and USDA workers, producers, and crop insurance representatives for use in crop damage assessments and
- Develop an unbiased, in-field method for damage evaluations for cotton.

Methodology

In an effort to document the effect of the hurricane on cotton, an Extension Evaluation Team was formed to develop methodology and conduct the evaluation in producer's fields. It was determined that data should be collected on two sampling dates. The first sampling date represented crop condition at or near the time of storm impact, and the second sampling date represented crop condition approximately 1 month after the initial sampling date.

Initial baseline data were collected in mid-August a few days after the storm by randomly selecting 15 fields from four producers to observe for the remainder of the growing season. The Extension Evaluation Team requested a list of all producers' fields. Team members had no prior knowledge of field location, historical problems, or yield potential. In an effort to avoid the unintentional introduction of bias, producers were not allowed to choose the fields for evaluation.

On the first sampling date, Extension team members located four sites within each field and marked them with wire flags. Each member counted 35 rows (30 to 35 meters) from each corner and moved into the field 30 to 35 meters to avoid an edge effect. At each site, 5 meters of row were measured and the following data collected:

- Stand count,
- Number of total sound bolls (not rotted or insect damaged),
- Rotten bolls, and
- Insect-damaged bolls.

At each field, a total of 10 plants were collected and mapped as described by Bourland & Watson (1990). Similar data were again collected on the second sampling date (approximately 1 month later) in the same fields at the previously marked sites. The Extension Evaluation Team conducted all site marking and data collection. Statistical comparisons to evaluate changes in cotton development, boll retention, and boll rot were made using a two-sample T-test analysis.

Results

Visual observation of the fields indicated a red coloration in the leaves, with small bolls and squares (floral buds) shedding within one week after the storm. Initial damage to the plants included leaf, square, and small boll bruising and plant lodging. Due to wet soil and wind, root systems were dislodged and moved such that the taproot, in alignment with the leaning mainstem, did not point downward. Fields generally did not have standing water for more than a few days, and plants did not wilt. It has been shown that the effects of this type of damage generally occur first in the leaves (Abeles, 1973; Beyer, Jr., 1975).

Plant growth after the storm was very slow and, in many cases, halted. Cotton height for the observation period remained almost constant, with an overall average change of 5 centimeters (Table 1). Likewise, few new reproductive branches were formed after the storm. Square and boll retention averaged 46% on the first fruiting position and did not change from the first to second observation date.

Table 1.
Effect of Storm Damage on Cotton Growth, Boll Development, and Boll Retention

	First Observation Date	Second Observation Date	

Measurement	Field Average	Standard Dev.	C.V.	Field Average	Standard Dev.	C.V.	Comparison p-value
Height (centimeters)	86	9	10	91	9	10	0.1610
Reproductive nodes (plant-1)	14	1	8	15	1	9	0.5407
Fruit retention on first position (%)	46	7	15	44	9	19	0.8383
Percent abscission on top 5 nodes (%)	65	6	9	78	16	20	0.0051
Total bolls (meter-1)	68	6	9	69	5	8	0.4823
Rotten bolls with insect damage (meter-1)	1.1	0.6	49	1.2	0.5	38	0.8889
Rotten bolls (%)	9	5	48	30	8	28	0.0001
Branches affected by boll rot (no. on reproductive nodes 1-5)	3.4	1.4	40	5	0	0	0.0004
Branches affected by boll rot (no. on reproductive nodes 6-10)	1.1	1.6	137	3.7	1.3	35	0.0001
Branches affected by boll rot (no. on reproductive nodes 11 and above)	0.2	0.4	207	0.9	1.1	118	0.1890
Stand (plants meter-1)	--	--	--	7	1	13	--

Visual observation by the evaluation team indicated that the squares and bolls located at the top of the plants were most affected. Fruit shed on the top 5 nodes increased from 65% (first observation date) to 78% (second observation date) after the storm. A majority of the bolls on the plant at the time of the storm were several days old and probably less vulnerable to physiological shed than young bolls and squares on the top of the plant (Guinn, 1979).

The yield potential was similar at both observation dates, with no change in total boll count from the first to second date (Table 1). Producers and Extension team members were concerned that boll rot damage caused by insects might increase due to the severe stress. However, the number of bolls that rotted as a result of insect feeding was low on both dates. Overall, boll rot increased in every field from the first to second observation date. Boll rot increased on average from 9 to 30%, possibly due to the matted, lodged plants, which likely reduced air movement and light penetration (Bennet et al., 1965). The number of fruiting branches that were affected increased over the observation period.

Conclusions

1. The data collected by the Extension Evaluation Team provided producers and crop insurance representatives an unbiased database for the storm-damaged cotton in southwest Alabama.

2. When Extension agents and specialists were asked to provide damage assessments, there were no published guidelines on which to base their evaluations. Crop damage assessments must be fair and unbiased in order to avoid over- or underestimation. Underestimation would be unfair to the producer, and overestimation would result in an unfair financial burden for insurance companies.

3. The overall methodology that was developed worked extremely well for evaluating the effects of the storm on cotton growth and development over time. Baseline data for the crop should be recorded as close to (if not before) the occurrence of the storm.

4. The basic methodology presented in this article for providing unbiased data can be used for other field crops; however, the data points collected must be changed to reflect the growth and development patterns of the crop.

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