PROGRESS IN THE DEVELOPMENT OF SAMPLING METHODS TO ESTIMATE COTTON LINT STICKINESS DUE TO SWEETPOTATO WHITEFLY INFESTATION

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Abstract

Cotton stickiness, due primarily to *Bemisia*, has become a limiting factor in cotton production in many countries, and may presently be considered by the cotton industry as the most serious factor affecting cotton quality. Enzyme-based technologies for ameliorating lint stickiness at either the pre-harvest or post-harvest stage are being developed. To most efficiently deploy these systems it will be necessary to determine whether a field is in need of remedial treatment for stickiness. Fairly standardized laboratory techniques (e.g. thermodetector) are available for indexing the stickiness of lint, but there is no standard methodology for collecting samples from the fields. Research was conducted in 1995-1997 in central AZ and Imperial Valley, CA to examine the distribution of sticky cotton lint, optimize the sample unit size, and determine the number of samples needed for the precise estimation of lint stickiness.

1995

Samples were collected on 1-4 dates at each of 5 field sites in Maricopa and Phoenix, AZ beginning about 2 weeks after the first appearance of open bolls. The frequency of chemical insecticide application was varied between sites in order to manipulate whitefly population densities and subsequent deposition of honeydew. Experimental sample units consisted of all open bolls on 1, 2, 5, 10, 20 or 30 consecutive plants. On a given sample date all six sample units were collected at each of five locations within each field along a diagonal transect. The time necessary to collect each sample was recorded. Each lint sample was mixed, weighed and ginned. An aliquot from this mixed sample was then assayed twice for stickiness using the manual thermodetector. There was no statistical difference in mean estimates of stickiness (thermodetector spots) among the six sample units. Typically, standard deviations were equal to or less than the mean for all sample units indicating a random or Poisson sampling distribution. This pattern differs markedly from the highly clumped sampling distribution of *Bemisia*. Relative net precision (a measure of the ratio between precision and cost) declined dramatically with increasing size of the sample unit from 1 to 30 plants. The 1-plant sample was the most cost-efficient.

1996

In 1996 we compared five smaller sample units at fields in Maricopa, AZ and Brawley, CA. As before a range of pest densities were established by differing frequencies of insecticide applications in 6 field sites at each location. Sample units consisted of all open bolls on 1 or 2 consecutive plants, or 5, 10 or 20 open bolls collected along an individual row. These three latter sample units consisted of bolls collected from all vertical strata on the plant. On two sample dates in Maricopa and one date in Brawley all five sample units were collected at each of ten locations within each field along a diagonal transect. The time necessary to collect each sample unit was recorded. Again each mixed aliquot was assayed twice for stickiness using the thermodetector method. All samples collected in 1996 were sent to Cotton Incorporated for assay using the automated high-speed thermodetector. Assays are incomplete and most analyses are pending. Lint from approximately one-third of all samples were sent to two additional laboratories for assay using the manual thermodetector. Partitioning of variance components indicated that the majority of variability was associated with assays done by different laboratories, with relatively little variation due to replicate assays at each laboratory or sample-to-sample differences in the field.

1997

Samples were collected on one date at three sites in Maricopa, AZ and Holtville, CA Sample units consisted of all open bolls on 1 plant, and 20 or 50 open bolls. All sample units were collected at 8-10 sites per field. Additional sample units were created by combining these primary units after ginning. Five, 10 and 20-plant sample units were formed from 1-plant units and 40, 80, 100 and 200-open boll samples were formed from 20 and 50-boll units. An aliquot from each sample was then assayed twice (blindly) for stickiness using the manual thermodetector. There were no significant differences in mean estimates of stickiness among the ten different sample units. Results again indicated that lint stickiness is randomly distributed in the field. Partitioning of variance components indicated that the majority of variability was associated with replicate assays of the same aliquot. Thus, given a finite amount of time to complete sampling, relatively more time should be spent on replicate assays than on collection of additional field samples. The optimal number of replicate samples to perform in the laboratory will depend on the ratio of field to laboratory costs. With the manual thermodetector, results indicate that a minimum of two assays should be completed on each sample. As processing speed increases with the automated system this optimal number may be even higher. Relative net precision was highest for 1-plant and 40-boll sample units. Preliminary sampling plans have been developed for the 1-plant sample unit. Results suggest that high precision (SE/mean ratio = 0.10) in stickiness estimates may be achieved with less than 25 sample units. Lower precision (e.g. 0.20) may be achieved with $\leq$ 5 sample units.

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