Evaluation of Petiole Sampling for Nitrogen

J.A. Tabor, D.A. Pennington, A.W. Warrick

Summary

Collecting a composite sample of 60 petioles from three representative 1 acre areas of a field, results in a sample average within 2000 ppm nitrate-nitrogen of the true average, 60% of the time. Increasing the number of areas sampled rather than the number of petioles collected will result in better estimates of the true field averages.

****

Twenty cotton farmers, members of Growers Pest Management (GPM) in southern Arizona, started a petiole sampling program during the summer of 1981. (Organizational support and education programs were provided by The University of Arizona Cooperative Extension Service.) This presented an opportunity to evaluate their sampling program and possibly determine more efficient methods of sampling. Petiole analysis is commonly used to monitor the nitrogen level in the plant, allowing growers to optimize their fertility programs during the growing season.

This first of two articles will evaluate the sampling accuracy of the GPM program. The second article will evaluate petiole and soil nitrate variability in the field and suggest modifications of the GPM sampling program.

The GPM program started sampling when the cotton plants were around 1 foot tall and continued past the second peak bloom period. The fields were sampled in the early part of each irrigation cycle from two to four representative areas, each 1 acre in size. A composite sample of 60 petioles from each field was sent to a commercial laboratory for analysis.

Research samples were collected by sampling behind the GPM sampler and separating each area sampled. Analysis of research samples from 28 fields indicate that sample averages can be considered to be within 1000 ppm NO_3-N of the true average 50% of the time, within 2000 ppm NO_3-N of the true average 60% of the time and within 3000 ppm NO_3-N of the true average 80% of the time. Table 1 lists a summary of the field sample data. The table includes a typical value and the range of values for the 28 fields.

By extrapolating from the data, it seems reasonable to expect that 80% of the time, the sample average will be within 2000 ppm NO_3-N of the true average by collecting from five area samples and within 1000 ppm of the true average by collecting from 15 area samples in the field.

Variability caused by size of field and plant maturity (early to late square) seems to be insignificant to variability of sampling itself.

Analysis of research samples from 1 acre areas indicates that by collecting 20 petioles over the area the sample average is within 1000 ppm NO_3-N of the true average 90% of the time and by collecting 40 petioles the sample average is within 1000 ppm NO-N of the true average 95% of the time.

Increasing the number of areas sampled will result in better field average estimates compared to increasing the total number of petioles collected from the same areas. The second article discusses methods of optimizing sampling techniques.

Table 1. Summary of Research Data from 28 Fields

	Typical	Range
Field sample average	10380 ppm NO_3-N	4780-15970 ppm NO_3-N
Number of area samples per field	3	2-4
Area of fields	38 ac	20-90 ac
Average number of nodes on plants sampled in each field	11	4-15
Average number of squares on plants on plants sampled in each field	8	1-18
Confidence of the average to be within 1000 ppm of the true average	50%	10-90%
Confidence of the average to be within 2000 ppm of the true average	60%	10-98%
Confidence of the average to be within 3000 ppm of the true average	80%	50-99%