

Alabama Farmers Wheat and Feed Grain Committee

Title: Airborne Imagery for Rapid Crop Productivity Assessments

Investigators: Gobena Huluka, Shannon H. Norwood, Paul L. Mask, and Joey N. Shaw  
Agronomy and Soils Department

Location: Tennessee Valley, Upper Coastal Plain

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**Progress Report For 2005**

This project was conducted on Paul Clark's farms in Decatur, Alabama. The two corn fields are located in the same proximity and B. Percy has received low medium and high treatments corresponding to 90, 130 and 160 lbs N/A, but field S3 was applied with a uniform rate (130 lbs/A) of N within a zone. However since the areas have been designated as zones, high yielding zone received the highest N rate and low yielding zone received lowest N rate for S3.

During the 2005 growing season, a total of 60 depth soil samples at 0-15, 15-30, 30-45 and 45-60 cm were collected from low (L), medium (M) and high (H) management zones on 03/14/05 before any fertilizer was applied. Similar samples were taken on 07/22/05 and 12/15/05. The soil samples were analyzed for pH, N, C, P, K, Ca, NO<sub>3</sub>-N and NH<sub>4</sub>-N. Also, corn leaves were sampled on 07/22/05 and analyzed for C, N, P, K, Ca, Mg and essential micronutrients. InTime (InTime Inc.) an imaging company, has made digital images of the corn fields on May 1; June 14-16; July 26 and September 5, 2006.

**Progress Report For 2005**

The location of the twelve soil samples (ten from B. Percy and two from S3 after the first sampling date) are shown in Figure 1. Within each management zone, samples with represent low, medium and high rates of N application were included.

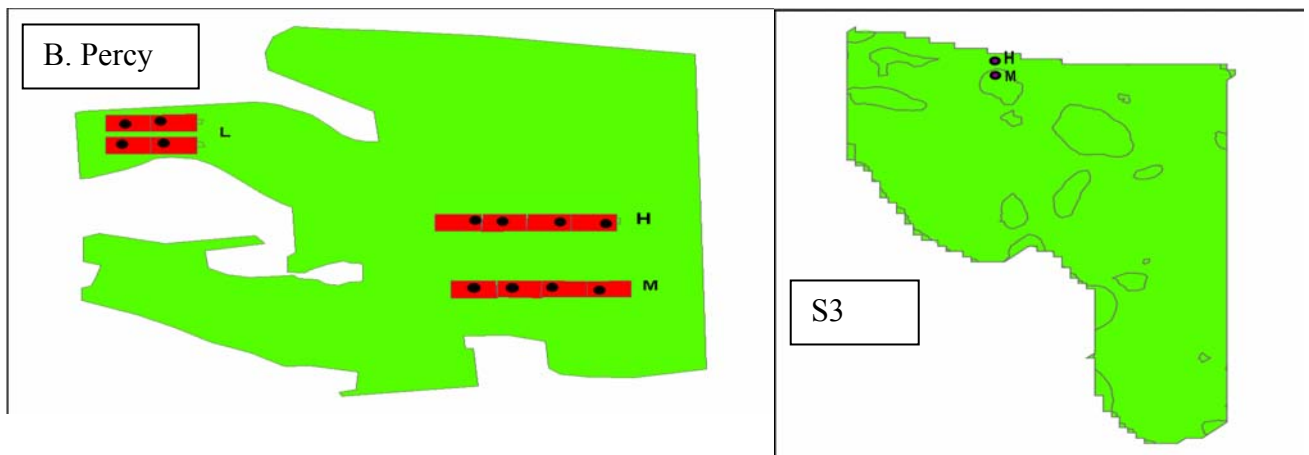


Figure 1: B. Percy and S3 corn fields and soil sample locations.

The classified digital images for the four dates for fields B. Percy and S3 and the actual corn yield (bu/A) are given in Figures 2 and 3, respectively.

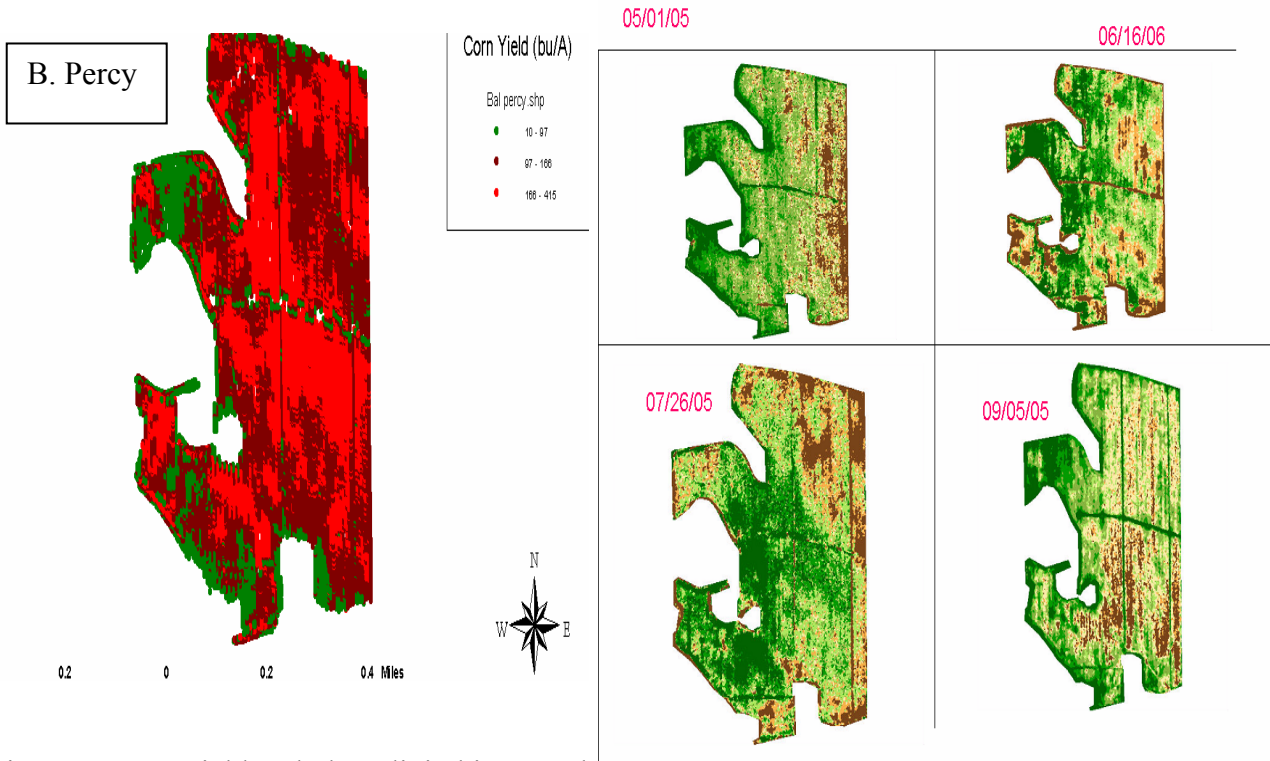


Figure 2: Corn yield and plant digital images during different dates for B. Percy.

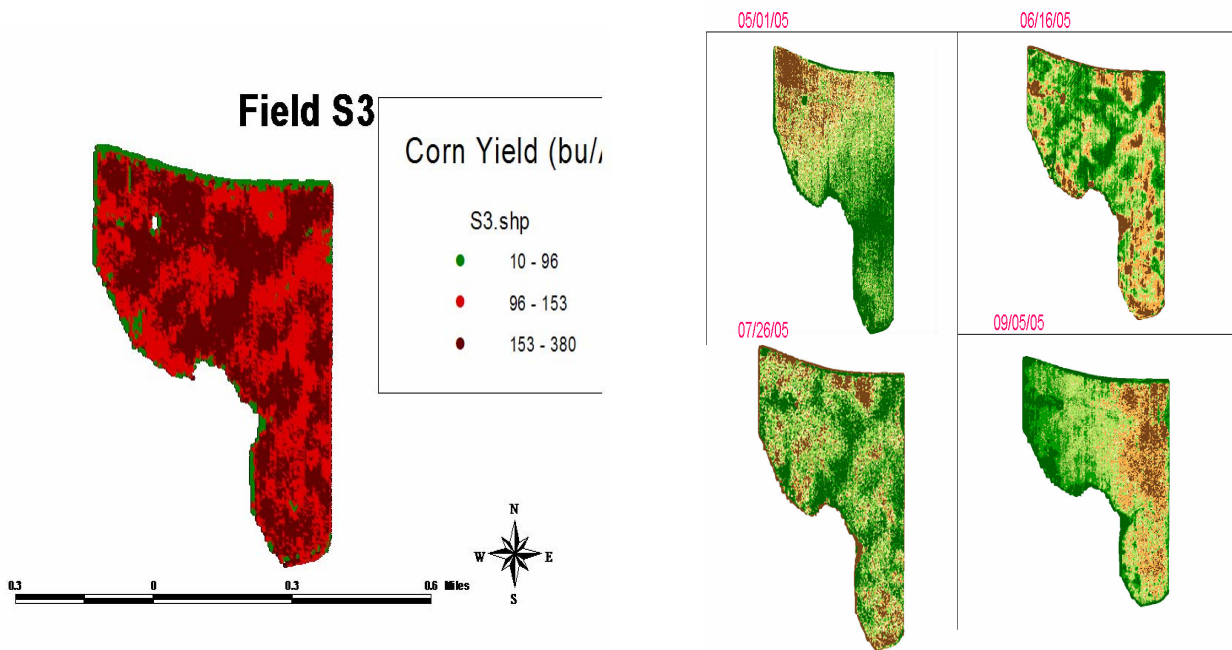
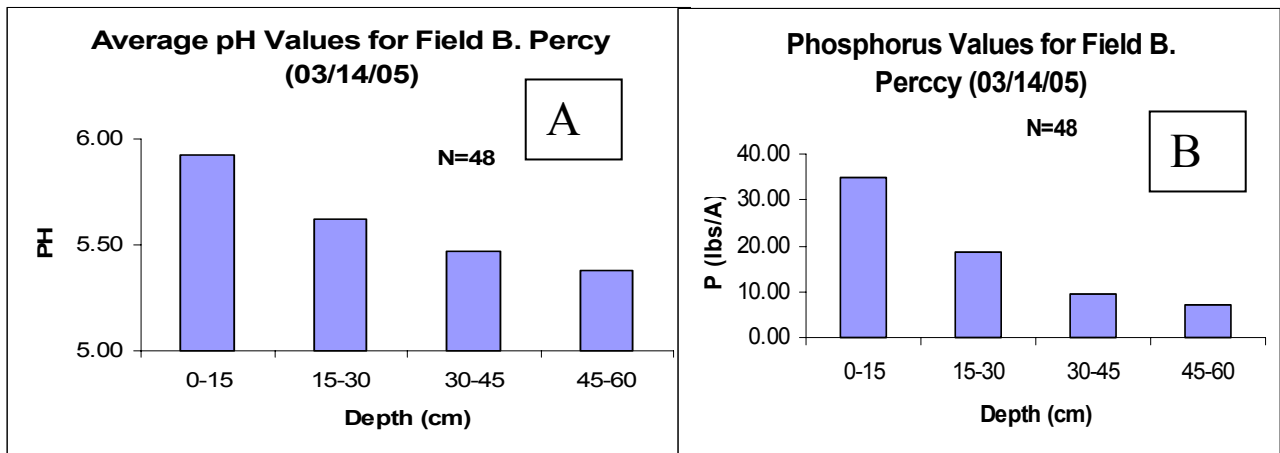


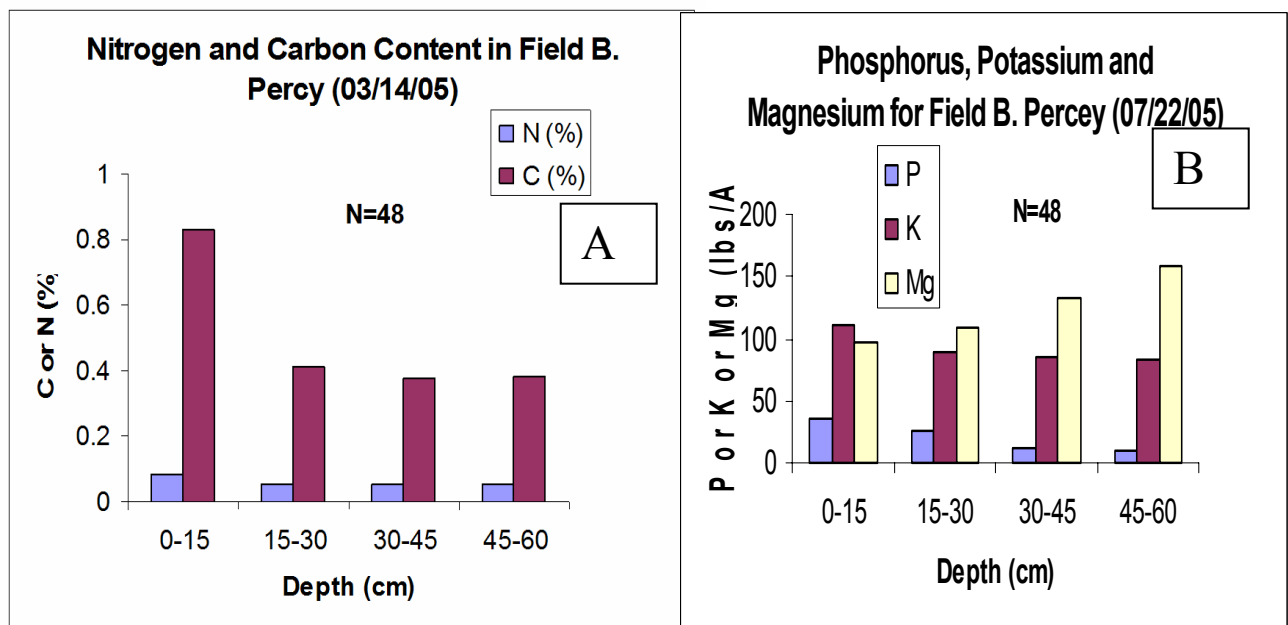
Figure 3: Corn yield and plant digital images during different dates for S3.

InTime digital images provide the health of corn plant at a given time and can be used to correct factors that might cause anomaly in time. Scouting of corn by digital image different times will help correct stress factors through application of irrigation/fertigation and/or other needed inputs. The bottom line is that InTime corn digital images can be invaluable tools to optimize corn production through appropriate and timely correction of production constraints.

Our soil analysis results examined included samples on 03/14, 07/22 and  $\text{NO}_3\text{-N}$  and  $\text{NH}_4\text{-N}$  of 12/15 and, in general, showed that the mean values of pH, P, K, Mg, Ca, N,  $\text{NO}_3\text{-N}$  and C of the topsoil (0-15 cm) were significantly different ( $p=0.05$ ) from the other depths. They all decreased as soil depth increased except Mg that increased with increasing depth.  $\text{NO}_3\text{-N}$  did not follow any of these patterns. Some of these values are shown in Figures 4 A & B and 5 A & B.

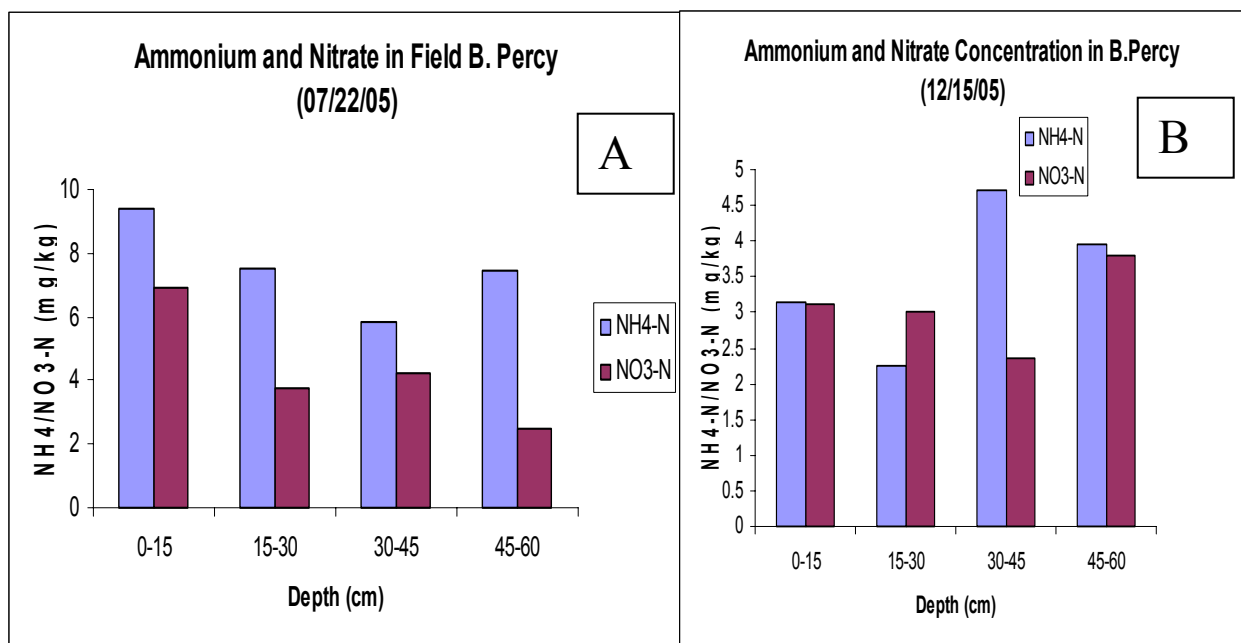


Figures 4 A & B: pH (A) and phosphorus (B) concentration, respectively.



Figures 5 A & B: C, N (A) and P, K, Mg (B) concentration, respectively.

Ammonium and NO<sub>3</sub>-N concentrations in the soil profiles were not time independent as seen for soil parameters presented in figures 4 and 5. The NH<sub>4</sub>-N and NO<sub>3</sub>-N average absolute values on 07/22/05 that is in the middle of corn growth were greater than the later sampling date 12/15/05. But as time progressed, the lowest depth had the highest concentrations of NO<sub>3</sub>-N. This is not unexpected since we had an unusually rainy season, and probably both nutrients were leached down the soil profile in the later sampling date. Just the opposite was true for the 03/14 sampling date (data not shown). It is clear from these data that both NH<sub>4</sub>-N and NO<sub>3</sub>-N were variably distributed in soil profile that may not be fully exploited by corn roots in the lower depths. Soil NH<sub>4</sub>-N and NO<sub>3</sub>-N with corn leaf chlorophyll and N concentration can be critical tools to remedy any N related stresses of corn plant.



Figures 6 A & B: Ammonium (A) and nitrate (B) concentration, respectively.

### Some Concluding Remarks

The results presented in this report are just a few examples of the data collected during the 2005 season. Two fields, four digital images of each field, three soil sampling dates with twelve sampling locations and four depths each and corn leaf on one of the sampling dates generate a lot of data to examine. What stands out clearly is the universality of variability (lack of uniformity) in space and in time across both fields. Some of the variable factors may not significantly affect corn production alone, but when they act in concert with others factors, they may synergistically impact production significantly. Even though the digital images of corn indicate the health status of the plant at a given time, identifying growth impacting/limiting factors and prescribing corrective measures in time is the crux of precision farming. Hence, adjusting the pH of soil for optimum corn growth through variable or blanket application of lime may have a significant impact in increasing corn production in these fields. More needs to be done in image analysis, constraint identification and prescribing corrective measures to fully exploit precision farming.