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REMOTE SENSING AS A POSSIBLE TOOL FOR HERBICIDE DRIFT DETECTION

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Abstract

In the past few years, problems with herbicide drift have increased. After a spray drift event occurs, producers are often faced with the difficult decision of whether to terminate the crop and replant or keep the crop in production. Previous research indicates that visual injury estimates and plant height reductions do not strongly correlate to yield losses from sub-lethal applications of non-target herbicides in cotton. The objective of this research was to investigate the possibility of using multi-spectral images for detecting and monitoring herbicide spray drift in cotton. This experiment was conducted at the Blackbelt Research and Extension Center in Brooksville, MS. A field (4.7 hectares) was planted with cotton 'Stoneville 4691B' on May 1, 2002. The field was then sub-divided into 0.07 hectare grids. At the pin-head growth stage, a simulated drift event from bromoxynil was imposed across the field. Applications were made at high concentrations on one corner of the field and applied at decreasing rates to form a concentration gradient across the field. Bromoxynil rates of 0.28, 0.14, 0.07, 0.04, 0.02, or 0.00 kg ai/ha were assigned to individual grids. Nine days after application, a multi-spectral image was taken of the entire field and visual injury ratings were taken at the center of each grid. Before harvesting, percent open bolls was recorded for each grid cell. Areas having a high number of unopened bolls were indicative of delayed maturity due to herbicide injury. Seed cotton yield was taken from 24 m^2 at the center of each grid. The image was analyzed by three different methods: unsupervised classification (computer decision model), supervised classification (using training areas), and normalized difference vegetative index (NDVI). Injury ratings, percent open bolls, and yield from the grid centers were interpolated across the field using ArcMap (inverse distance weighted, power = 4, nearest neighbor = 4).

Unsupervised and supervised classification resulted in an overall accuracy of 73 and 69% for classifying bromoxynil rate. An unsupervised classification method resulted in accuracies of 39 to 79% for classifying bromoxynil rates of 0.02 to 0.28 kg ai/ha. This method resulted in a 94% accuracy of identifying untreated areas. A supervised classification method resulted in accuracies of 38 to 82% for classifying bromoxynil rates of 0.02 to 0.28 kg ai/ha. This method resulted in a 95% accuracy of identifying untreated areas. NDVI also provided a good indication of injury across the field. Higher rates of bromoxynil corresponded to higher visible injury ratings, lower percent bolls open, and lower seed cotton yield.

The supervised or unsupervised classification method resulted in a 94 to 95% accuracy of identifying the untreated area. Errors in classification were most often associated with trying to differentiate rates rather than identifying areas where a drift event had occurred. Differentiation among rates was not as good because it appears that the effect of the herbicides on reflectance was similar, regardless of rates. This would indicate that there is a great potential for using multi-spectral images to identify herbicide drift. Further research will be needed to determine the correlation between reflectance and potential yield losses.