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REAL-TIME SITE-SPECIFIC WEED MANAGEMENT IN COTTON: ECOMONIC EVALUATION AND WEED SPATIAL DISTRIBUTION

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Abstract

Cotton (*Gossypium hirsutum*) requires more herbicide inputs than many other U.S. crops. Although selective herbicide technology has improved over the last 50 years (lb ai/A to oz ai/A), little advance has been made in spray-application technology. Weed-sensing sprayers apply pesticide only where it is needed and avoid expensive and time consuming requirements for scouting, collecting, and interpreting numerous data. Sensors emit a light source and then detects the ratio of red to near infrared light reflecting back from the ground and surrounding vegetation. Where green vegetation exists, less red light is reflected thus altering the ratio and triggering a spray event. Plastic hoods must be used in row crops to exclude crop plants from the detection area. Rather than band herbicides over the crop plants between the plastic hoods, spray events between the rows trigger drill applications of herbicides. In theory, weeds grow in patchy patterns. By automatically triggering spray applications over the crop plants only when weeds are detected in the adjacent row middles, herbicide application can be reduced in the area over the crop plants. Information on economic return of weed management systems that utilize weed-sensing sprayers is needed. The objectives of this study were to determine the feasibility of weed management with a sensor sprayer in cotton as compared to conventional standards and postemergence herbicides systems selected by computer software (HADSS, "Herbicide Application Decision Support System"). Additional objectives were to assess spray reduction and weed management cost from the various herbicide systems and to assess the feasibility of on-the-drill application based on weed detection between the rows.

Studies were conducted in 2002 at Kinston, NC. A randomized complete block design was replicated three times. Plots were 25-ft wide by 100-ft long and contained eight 38-in crop rows. Preemergence (PRE) herbicides included Prowl at 1.0 lb ai/A plus Cotoran at 1.0 lb ai/A. The last herbicide treatment (LAYBY) consisted of Caparol at 1.0 lb ai/A plus MSMA at 2.0 lb ai/A with 0.25% (v/v) nonionic surfactant. The study included the following six herbicide systems: 1) PRE herbicides followed by (fb) extension recommended herbicide (Roundup Ultramax at 1.0 lb ai/A) postemergence (POST) fb LAYBY; 2) System 1 with HADSS-recommended POST herbicides; 3) No PRE herbicides with HADSS- recommended POST herbicides fb LAYBY; 4) PRE herbicides fb HADSS deciding the herbicide to use with the weed-sensing sprayer; 5) the previous system except without PRE herbicides; 6) a treatment that did not receive any herbicides; and 7) a weed-free control.

All herbicide systems controlled carpetweed (*Mollugo verticillata*), ivyleaf morningglory (*Ipomoea hederacea*), large crabgrass (*Digitaria sangiunalis*), sicklepod (*Senna obtusifolia*), and slender amaranth (*Amaranthus gracilis*) at least 98% late in the season. Cotton injury in the form of stunting was observed in treatments that received PRE herbicides and is likely due to Cotoran application. Treatments that received herbicides had greater yields than treatments that did not receive herbicides. Lint yields averaged 1290 lb/A and were not different among treatments that received herbicides. Weed spatial distribution was recorded in the form of percent spray nozzle activation per second. Weed populations in treatments that received PRE herbicides were clustered in small dense patches which resulted in 85-95% POST herbicide spray reduction. Weeds populations in treatments that did not receive PRE herbicides were more uniformly distributed across the plots. The resultant herbicide spray reduction in these plots ranged from 5-46%, further illustrating the patchy nature of weed populations. Herbicide costs reflected reduction in spray associated with the weed-sensing sprayer. Herbicide costs were lowest when the weed sensing sprayer was used without PRE herbicides, at $12.58/A. When used with PRE herbicides, cost of herbicides using the weed-sensing sprayer was $18.26/A. Broadcast applications of all herbicides cost $34.65/A. Net returns reflected trends in yield more than herbicide cost reductions. Weed sensing sprayers offer cotton producers a valuable tool to reduce herbicide costs while maintaining net returns and weed control efficacy.