paired field, and other designs. There is no "one-size fits all" when it comes to field-scale experimental designs. Experiments are designed based upon field characteristics, experimental treatments to test, preferences of individual farmers, and available machinery. Once the experimental design is chosen, GPS guidance and automated controllers can reduce the in-field management required to implement the experiment while increasing the likelihood of accurate execution of the design.

Additional factors specific to on-farm trials should be kept in mind prior to harvest. It is recommended that the harvester's GPS equipment is checked to make sure it is working, that differential correction is being received, and that the GPS firmware version is current. For most trials, it is important for weeds in field-scale experiments to be adequately controlled as to not interfere with harvester operation and moisture sensor measurements. It is especially important that the yield monitor be properly calibrated prior to harvest, after all it is not the field average yield that is of interest but the within field yield and variability that will be analyzed.

Once yield data has been recorded, most farmers desire the results of the experiment as quickly as possible in order to plan for the next production season and make input orders soon enough to secure early order discounts. Some farmers may analyze the data themselves while others opt to rely upon third party analysts. Either way, the appropriate spatial analysis technique is necessary to make adequate production recommendations and farm management decisions. Although it is expected that the majority of yield data analysis is conducted by visual comparison of maps, quantitative data analysis has become more prevalent with advances in farm-level mapping software.

Discussions will address why appropriate spatial analysis techniques are necessary and include results of a three-year case study of how farmers have used their yield monitor data from on-farm trials to enhance farm management decisions.

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▸ Cotton Crop Vigor And Tarnished Plant Bugs – Should Management Change Across Variable Fields?

Presented by Dr. Tina Gray Teague

Professor of Entomology, Arkansas State University - University of Arkansas Agricultural Experiment Station

With availability of site-specific, variable rate application technology in cotton, producers in the Midsouth are interested in whether these new tools can be used to reduce crop protection costs for insect pests. Unlike variable rate applications made with plant growth regulators or harvest aid materials, site-specific insecticide sprays should be applied as "on" or "off". Ideally, insecticide prescriptions in an IPM system would direct sprays only at infested and susceptible crop plants. No spray would be applied in non-infested or to tolerant crop plants.

In recent cotton research efforts in Arkansas, we have focused on trying to make better use of crop tolerance and compensation capacity in decision making for managing insect pests. In work beginning in 2003, we examined response of non-stressed plants and plants under pre-flower water deficit stress to square loss following feeding by tarnished plant bug (Lygus lineolaris Palisot de Beauvois). The experiment was conducted in a commercial cotton field at Wildy Farms located in Northeast Arkansas near Leachville. Water stress was induced by delaying irrigation initiation, and insect induced injury was manipulated by augmenting natural field populations of plant bugs with lab reared nymphs and by application of insecticides. Our objective was to compare crop response and compensation with and without pre-flower water deficits coupled with square loss resulting from plant bug feeding. In the 2003 trial, irrigation significantly increased lint yield. Plant bug feeding injury delayed crop maturity, but bug feeding did not uniformly reduce yield. Bug induced injury resulted in reduced yields in non-irrigated plants; however, irrigated plants were able to tolerate and/or compensate from similar levels of insect injury. Yields produced were similar to those produced in cotton receiving weekly applications of insecticide. Simply said, non-water stressed plants were able to recover from moderate levels of pre-flower square loss; stressed plants were not.

These studies were expanded in 2005 and 2006 to include a crop "vigor" component. The soil in the Wildy Farms field was a Routon-Dundee-Crevasse Complex. Interlaced through the field were easily identifiable inclusions of coarse-textured soils. This soil variability, common across the cotton production area, is associated with sand blows related to the 1812 New Madrid earthquake. In the first month after planting, plant biomass assessments across the variable field were used to classify crop areas of high and low plant vigor (plants located in the "sand blows" were in the low vigor class). In a split-plot design, field plots were positioned across these variable plant types. Three factors were evaluated: irrigation (2 levels), plant vigor classification (2 levels) and insect induced injury (4 levels). The 2*2*4 split-plot factorial experiment was arranged in a randomized complete block design. Irrigation treatments were considered main plots. The subplots were comprised of 8 treatment combinations where each combination was one of the 2 vigor classes and 4 plant bug injury treatments. Three blocks were used, and each treatment combination occurred only once in each block. Treatments were re-randomized in each year. Irrigation treatments were: 1) weekly (as needed) furrow irrigations, 2) no supplemental irrigation. Plant vigor treatments were: 1) high vigor, 2) low vigor. Plant bug treatments were 1) manual infestation of 3 plant bug nymphs per m of row in weeks 1 and 2 of squaring; 2) manual infestation of 9 bugs per m of row in weeks 1 and 2 of squaring; 3) untreated, natural populations; 4) sprayed with insecticide.

First position square retention varied from 98% to 71% at first flowers across treatments; total number of main stem sympodia ranged from 3.4 nodes per plant in non-irrigated low vigor plants to 10 nodes in irrigated high vigor plants. Irrigation significantly affected yield and fiber quality in 2005, but insect induced injury was not a limiting factor. When bugs were released on low vigor plants in 2005, the insects failed to cause sufficient damage to have measurable effects on yield even under water deficit stress. These plants were very small, and at the time of bug releases, hot and dry conditions likely reduced bug survival. Conditions were favorable for plant bug survival in 2006, and bug feeding injury in non-irrigated, low vigor plants resulted in reduced yield. Irrigated plants and high vigor classed plants infested with plant bugs suffered similar levels of square shed as low vigor plants, but high vigor plants were able to compensate for the injury. Results from this study indicate that there are differences in compensation capacity of plants across variable fields. These data suggest that IF plant bug infestations develop pre-flower in low vigor areas, those plants may not compensate for injury as well as high vigor classed plants. Action thresholds in Arkansas for tarnished plant bug are based on pest insect numbers as well as fruit retention. Thresholds in place in 2006 were sufficiently conservative for the lower pest tolerance of low vigor plants. Dynamic thresholds across variable fields could be considered pre-flower with a higher threshold applied in field areas with more tolerant plants.

Differences in crop susceptibility among vigor classes also has been measured late-season in studies at Wildy Farms. Significant differences in days to physiological cutout (nodes above white flower = 5) were observed in field areas (management zones) with low vigor classed plants compared to plants from medium and high vigor classifications. High yielding, high vigor classed plants remained vulnerable to insect feeding 5 to 18 days longer in the season. New infestations of plant bugs occurring after a crop, or management zone, has reached NAWF=5 +350 DD60s are unlikely to result in crop damage. Scouting, as well as spraying, for plant bugs could be suspended in those management zones under such conditions.

Managers considering site specific approaches for insect control should take into account variability in plant compensation capacity and tolerance for pest injury. Good crop production practices including judicious use of fertilizers and plant growth regulators along with appropriate irrigation management can increase crop tolerance to pest injury and allow growers to achieve high yields and early harvest.

▸ Site-Specific Nematode Management In Cotton Production

Presented by Maurice C. Wolcott
Research Associate, Plant Pathology, LSU AgCenter

Many cotton producers in the MidSouth have experienced increased losses due to plant parasitic nematodes in recent years. While convenient, current producer standards of in-furrow treatments or seed treatments may not provide adequate levels of control in those portions of production fields where soil conditions and damaging nematode population levels combine with environmental conditions to maximize nematode damage.

Current management strategies used to reduce losses due to nematode infestations include crop rotation and/or nematicide application. Applications of nematicides are generally made uniformly across problem fields, although nematode damage is usually not uniformly distributed throughout problem fields; therefore the field-wide uniform application of nematicides can result in application to areas where either no nematodes are present, or populations are below economic threshold levels. The result is potentially adverse both economically and environmentally. In recent years, advances in site-specific management technologies have made it possible to apply soil fumigants for nematode control to only those areas susceptible to the highest levels of damage, without having to treat entire fields. The success of this concept will depend upon the ability to create prescription maps that are both accurate and affordable. Costs for labor, time, and laboratory assays related to intensive spatial or grid sampling to determine nematode population densities would typically be prohibitive. Alternative methods to accurately determine those areas of production fields in which plant parasitic nematodes have the potential to adversely affect crop yields are needed.

Soil type and texture have been shown to have a significant effect upon nematode population densities as well as distribution of nematode species. If the spatial distribution of soil texture within production fields could be economically and accurately mapped with sufficient detail, these maps might serve as the basis for site-specific nematode management. Recent research in Arkansas (Monfort et al) and Louisiana has shown that nematode populations alone are not a reliable indicator of potential response to nematicide application, and that nematode population thresholds change in relation to soil texture. Previous work in Louisiana has shown that adverse effects of root-knot nematode on cotton yield were more related to soil textural differences through the soil profile than to fall nematode population. The potential for the use of apparent bulk soil electrical conductivity (EC_a) measurements in developing management zones for root-knot nematode in Mississippi River alluvial soils has also been discussed (Overstreet et al.,