SPATIAL EXAMINATION OF SOIL FACTORS ON COTTON SEEDLING DISEASE PRESSURE

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Abstract

One of many crop management practices being adopted by cotton growers is site-specific management, which involves observing, measuring, and responding to field variables as they change across a field in order to optimize crop inputs for specific sites to maximize yield potential. The cotton seedling disease complex, which includes the soilborne pathogens *Thielaviopsis basicola, Rhizoctonia solani, Fusarium* spp., and *Pythium* spp., reduces seed germination, plant emergence, and growth and development resulting in poor stands or stand failures. Cotton affected by seedling diseases are usually seen as patches within fields. Predicting and preemptive management for these patches using site-specific management could provide more uniform stand establishment. The environment plays a large role in diseases. Determining soil environmental factors that correlate with stand loss from disease could provide information for predicting areas within fields with high disease potential. The objectives of this study were to (1) determine the spatial distribution of minimal soil temperature, soil water content, soil texture, and stand counts across cotton fields and (2) determine a reliable method of predicting or forecasting for seedling disease management zones. This experiment was conducted in a 1.1 hectare field at the Judd Hill Cooperative Research Foundation in Poinsett County in Northeast Arkansas in which 5, 4 row strips were planted to spatially represent this field. Each strip was divided into 10, 15.25 meter long georeferenced plots. Each 4-row plot had a row planted with each of the four fungicide seed treatments (1) no fungicide treatment, (2) Allegiance FL (1.5 oz/cwt), (3) RTU-PCNB (14.5 oz/cwt), and (4) Vortex + Spera + Allegiance + Evergol Prime + Evergol Energy (0.08+1.8+1.5+0.32+2.0 oz/cwt). All 4 seed treatments were treated with Gaucho 600 (12.8 oz/cwt). For the first objective, minimal soil temperature 1 and 5 days after planting was collected for each plot and using Moran's I were found to have spatial autocorrelation values of 0.73 and 0.48 (P=0.001). Moran's I values >0 indicate aggregated spatial distributions if the Pseudo P-value is less that 0.10. Minimal soil temperature over the study site 1 day after planting ranged from 20.2°C to 21.5°C, and 5 days after planting ranged from 21.7°C to 22.5°C. Soil water content also was measured 1 and 5 days after planting and had Moran's I values of 0.50 and 0.70 (P=0.001). Soil water content 1 day after planting ranged from 9.4% to 16.8%, and 5 days after planting ranged from 12.1% to 20.1%. Soil texture had a Moran's I value of 0.33 (P=0.007). Soil texture ranged from 21.6 % sand to 66.2% sand. Moran's I values for stand counts 21 days after planting for each treatment were (1) 0.54 (P =0.001), (2) 0.4 (P =0.001), (3) 0.37 (P =0.002), and (4) 0.30 (P =0.011). For the second objective, ordinary least squares and spatial lag regression models found correlations between soil temperatures 1 day after planting and stand counts of each treatment were significant; (1) P=0.002, t-statistic=3.07; (2) P <.0001, t-statistic=5.2; (3) P <.0001, t-statistic=5.1; and (4) P =0.00013, t-statistic=4.2. Correlations between soil temperature 5 days after planting and stand counts were (1) P =0.008, t-statistic=2.8; (2) P =0.03, t-statistic=2.25; (3) P <.0001, t-statistic=4.5; and (4) P =0.08, t-statistic=1.7. Soil water 1 day after planting was not significantly correlated to stand counts. Soil water 5 days after planting was correlated with stand counts for treatments (1) P =0.0009, t-statistic 3.5 and (2) P =0.07, t-statistic-1.8. Soil texture was not significantly correlated with stand counts. Relative fungicide response ratios were calculated by dividing the treated by the non-treated stand count for each plot for a measurement of stand loss from seedling diseases. The significant correlations between soil factors and relative response ratios for the complete fungicide seed treatment (4) were soil temperature 1 day after planting and 4/1, P=0.05 t-statistic=-1.99; soil water 5 days after planting, and 4/1, P=0.01, t-statistic=-2.67. These results indicate that areas with high seedling disease pressure occurred in patches that were associated with low soil temperature and soil water. Variable rates of inputs could potentially be used to increase effective management of areas with high seedling disease potential based on soil environment at planting.