Feasibility of Variable Rate Fungicide With the Use of Multispectral Imagery

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ABSTRACT

In Arkansas, most of the 1.5 million acres of rice planted are susceptible to sheath blight and other fungi (NASS, 2003; Cartwright and Lee, 2003). Treatments for these inputs typically cost in excess of $20/acre, making fungicides one of the most expensive inputs in rice production. In the past, multispectral imagery has shown significant possibilities for identifying areas of plant stress. This study examines the possibility of using multispectral aerial imagery as a tool in identifying signs of fungal infestation. The fields were observed weekly for any instances of stress or disease identified by the multispectral imagery. The economic impact on rice production was considered from a variable rate perspective, and in this study yielded a 63% savings.

INTRODUCTION

The feasibility of a variable rate fungicide application was examined in a study performed on an Arkansas rice field in Prairie County. The intent of this study was to develop a method for reducing input costs by varying the rate of costly fungicide and thereby distributing the fungicide more efficiently while reducing expenditures.

PROCEDURES

Multispectral images were obtained using a Duncan Tech CIR camera mounted in a small aircraft. The imagery was obtained each week during the vegetative growth stages, at a resolution of approximately 2 meters. The camera uses three filters set at
different wavelengths of 550 nm, 600 nm, and 800 nm with intervals of around 30 nm. The imagery was geo-referenced using the corresponding digital orthophotoquad downloaded from the Center for Advanced Spatial Technology. The imagery was then classified into 7 biomass groups using the normalized-difference vegetation index function. These classified images were used to verify each of the biomass groups using a handheld computer in conjunction with differential global positional system (DGPS) image display software. Each of the biomass classes was evaluated with regard to plant vigor (biomass), insect damage, and disease. Biomass classes that contained sheath blight infestations were assigned a 14 oz of Stratego fungicide rate, while the areas with no instances of sheath blight were assigned a rate of zero.

RESULTS AND DISCUSSION

The early season imagery acquired was found to correlate well with field observations of plant biomass. The image acquired on 21 June 2003 was found to contain distinct classes that corresponded with observed sheath blight infestation. The heaviest instances of sheath blight were found in the northwestern quadrant of the field (Fig. 1). This 21 June 2003 image was acquired just prior to booting. At this time the sheath blight was on the lower portion of the rice plant. A surface of the elevation (Fig. 2) was constructed by digitizing the levees in the aerial photographs in an effort to observe any relationship between the disease and elevation. Sheath blight is typically found in the lower end of the rice field (Cartwright and Lee, 2003). Even though a variable rate (VR) applicator was not available, a prescription map was made to establish the possibility of VR treatment (Fig. 3). There were two assigned rates of Stratego, 14 oz and zero. This was regarded as a cost-saving management decision since Stratego and other recommended fungicides typically cost in excess of $20/acre. In the case of this study, a VR application would have resulted in an estimated saving of 63% as opposed to a full rate across the entire field.

SIGNIFICANCE OF FINDINGS

The results of this study have indicated that there are significant opportunities to reduce rice production costs. This approach is expected to become more practical in the future as aerial variable rate applicators become more prevalent. The imagery was found to correlate well with field observations of plant biomass (vigor). Several of the classes identified “pockets” of sheath blight that were verified by DGPS scouting evaluation of the classified imagery.

LITERATURE CITED


Fig. 1. Classified multispectral image acquired on 21 June 2004.
Fig. 2. Elevation map on which the sheath blight was found in the lower portion of the field.

Fig. 3. Variable rate application map.