ABSTRACT

Changes in corn canopy reflectance due to nitrogen differences may be remotely sensed. This would allow crop nitrogen needs to be diagnosed for large and non-homogeneous production areas without intensive and expensive field sampling operations. The capabilities of single date (early- and mid-season), multispectral (visible and NIR), and high spatial resolution (<2.4 m) satellite (QuickBird) or aerial remote sensing images to assess crop condition in response to variations in nitrogen rate were studied in four corn fields, located in Southern Minnesota during the crop seasons of 2003 and 2004. Since the value of satellite or aerial images can often be overshadowed by operation costs and scheduling inflexibility, the capabilities of an Unmanned Aerial Vehicle (UAV) to acquire good quality images were also studied. Early-season satellite images failed to detect significant crop response to nitrogen fertilizer or accurately predict Economic Optimum Nitrogen Rates (EONR) due to the large soil background effect, but later in the growing season, mid-season imagery revealed significant crop response to nitrogen fertilizer and separability between poorly and well fertilized areas at a probability level of α=0.05. Mid-season remote sensing information often indicated the yield potential of zones within a field, but did not indicate the amount of nitrogen fertilizer required for optimum production. These results were attributed to the fact that there was not a strong relationship between EONR and the yield capacity of a zone due to nitrogen fertilizer applications. Variability in nitrogen fertilizer use efficiency within the field produced zones that required high EONRs but not high yields. Since final yields do not closely depend on crop status at a specific growth stage, different results can be anticipated when studying the crop at different times during the growing season. However, scheduling and acquiring remote sensing imagery at frequent intervals with current remote sensing systems was difficult. The UAV was limited in acquiring high quality images at a high frequency within the crop season, due to difficulties in operating and stabilizing it under inclement weather conditions that caused severe geometric and radiometric errors in the images.

Key words: Remote sensing, optimum N rates, crop response, unmanned aerial vehicles.