VARIABLE-RATE APPLICATION OF NITROGEN AND POTASSIUM FERTILIZERS IN LOUISIANA SUGARCANE PRODUCTION SYSTEMS.

R. M. Johnson

USDA-ARS, Sugarcane Research Unit, Houma, Louisiana

Blaine Viator

Calvin Viator, Ph.D. & Associates, LLC, Thibodaux, Louisiana

INTRODUCTION

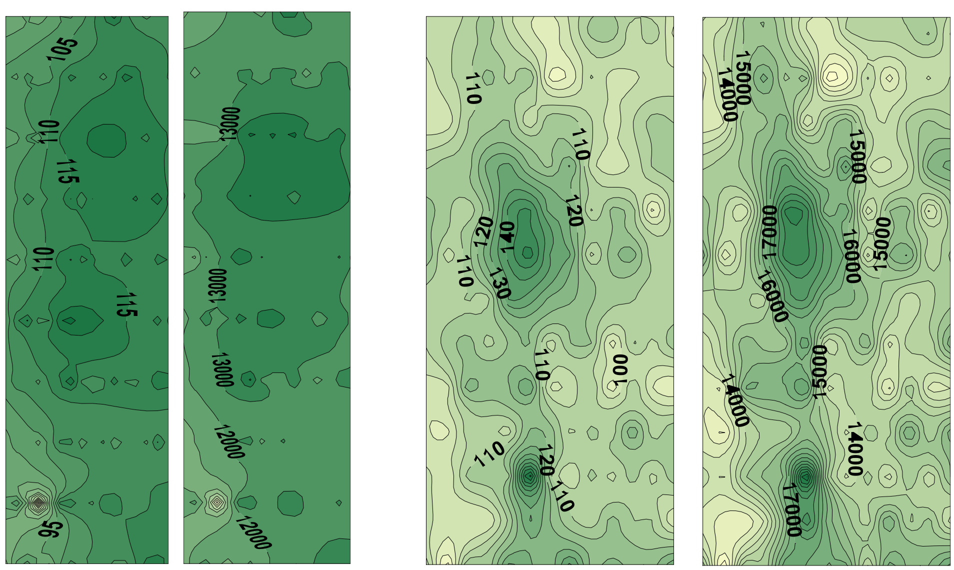
For sugar and cane yields to be optimized and profitability maximized, it is critical that the developing sugarcane crop receive the prescribed level of plant nutrients. Under-fertilization can result in reduced cane yields, while over-fertilization can reduce sugar recovery. In addition, improper fertilization may increase crop susceptibility to environmental stress and disease and insect pests, as well as cause adverse impacts on the environment. Nitrogen (N) continues to be one of the most important and costly components of a sugarcane fertility program, directly affecting both cane and sugar yields. While potassium (K), a nutrient associated with plant water use, may aid in drought tolerance. Potassium deficient plants are also more prone to contract certain diseases and are more likely to lodge. It is therefore essential that the proper rates of both N and K be applied to optimize cane and sugar yields. The objective of these studies was to determine if variable-rate (VR) application of N and K could help optimize sugarcane yields, while increasing production efficiency.

METHODS

Two commercial fields of 'Ho-CP 96-540' were selected in 2012 for these studies: a 3.0-ha field of plant cane for the N trial and a 7.0-ha field of plant cane for the K trial. For the N trials, a Veris soil electrical conductivity (EC) mapper was used to identify areas in the field with a similar soil texture or soil type. Three zones were developed and corresponding nitrogen rates of 90, 100, 112 kg N ha^{-1} were applied. The lowest N rate was applied to the lighter (silt loam) soil and the higher rates were applied to the heavier (clay) soil. The VR N treatment was compared to a uniform application of 100 kg N ha^{-1}. Approximately the same total amount of N was applied by both the VR and uniform treatments in the test site. This may not be the case for other locations and conditions. For the K trials, management zones were determined by grid soil sampling, using a 0.75-ha grid. Three zones were developed with corresponding rates of 110, 147, 184 kg K_2O ha^{-1}. It was not possible to compare yields from a uniform application in the K trials, but yield variability was evaluated. To estimate yields, selected rows from each field were harvested in 30.5-m increments in the K trial and 36.5-m in the N-trial, using a John Deere, single-row chopper harvester. Cane yields were determined using a field transport wagon equipped with electronic load sensors, and theoretically recoverable sucrose (TRS) levels were estimated by the core-press method.

RESULTS

Results from the N trial in 2012 showed that both cane and sugar yields exhibited significant variability with yields ranging from 37 to 127 t cane ha^{-1}, 93 to 129 kg sugar t^{-1}, and 4,480 to 15,190 kg sugar ha^{-1}. In 2013, yields ranged from 61 to 142 t cane ha^{-1}, 80 to 117 kg sugar t^{-1}, and 6,290 to 16,180 kg sugar ha^{-1}. No significant differences between the VR and uniform application procedures were observed in N trials in either year. Substantial variability was also observed in the K trials in 2012, with yields ranging from 84-161 t cane ha^{-1}, 116-147 kg sugar t^{-1}, and 11,160 to 21,000 kg sugar ha^{-1}. In 2013, cane and sugar yields from the first-ratoon crop exhibited a level of variability that was comparable to that exhibited in the plant-cane trial, with yields ranging from 69-110 t cane ha^{-1}, 112-137 kg sugar t^{-1}, and 8,500 to 13,683 kg sugar ha^{-1}. Spatial maps of cane and sugar yields from both the N (Figure 1a, 1b) and K (Figure 1c, 1d) trials exhibit significant spatial correlation, with variability in the K trial more closely correlated with the developed management zones than in the N trial. Results suggest that VR application of both N and K may offer Louisiana sugarcane producers a viable method to decrease costs, while increasing production efficiency.



1a 1b 1c 1d

Figure 1. Contour plots from 2012 VR N experiment for **a,** cane yield (Mg ha^{-1}) and **b,** sugar yield (kg ha^{-1}), and contour plots from 2012 VR K experiment for **c,** cane yield (Mg ha^{-1}) and **d,** sugar yield (kg ha^{-1}).