Meeting the Nutrient Demands of Modern Sugarcane Varieties


Traditional practice within the average sugarcane field in Maharashtra is producing yields that are far below their potential. This study tests the current fertilization recommendation scheme with a modern crop variety to determine the viability of increasing the supply of nutrients that are commonly known to be either yield limiting or entirely avoided by growers.

In the western State of Maharashtra, the sugarcane agro-industry is second only to cotton in terms of economic importance. The crop has brought many desirable changes in social, economic, educational, and political life throughout its rural areas. High yields are possible and the three planting seasons, and ratoon crops sprouted from a previously harvested crop, can produce 200 to 270 t/ha. However, the state’s average cane yield is only 85 t/ha. An important part of bridging this yield gap is adequate nutrient supply. Numerous research reports indicate that nutrient deficiencies are increasingly prevalent in cane-growing soils of Maharashtra amidst a lack of emphasis on maintaining soil fertility (Phonde et al., 2005). The impact of high-yielding varieties is an additional concern, as current nutrient recommendations should consider both the potential for both declining soil fertility as well as increasing crop demand.

The study below was designed to evaluate the effects of macro-, secondary-, and micro-nutrients on crop yield, quality and economics on a new high-yielding sugarcane variety. Previous yield trials with this variety show a 20% yield advantage compared to other commonly used varieties.

A split-plot design field study with three replications was carried out from 2009 to 2011 at Manjari and Warna in Maharashtra. Main treatments included a state recommended fertilizer dose (RDF) of 340-170-170 kg N-P₂O₅-K₂O/ha, which was tested against 125%, 150% and 175% of the RDF (Table 1). Sub-treatments included a control with NPK but no secondary or micronutrients, as well as five combinations of S, Fe, Zn, B, and Mn—each applied at its recommended rate.

Results

Cane yields increased significantly with increasing rates of NPK compared to the RDF (Table 1). While the highest cane yield at Manjari was obtained with 150% RDF treatment, the highest yield at Warna was obtained with 175% RDF. In Manjari, S3 (S+Fe+Zn) significantly increased cane yield over the control, but yields were not significantly different from the application of S alone. In Warna, S4 (S+Fe+Zn+B) significantly increased cane yields over the control, but its effect was not significantly different from S3.

Commercial cane sugar yields, on the other hand, showed no significant response to NPK application rates above the RDF or to further addition of secondary and micronutrients (Table 1). Juice quality parameters such as brix and pol (Table 2) as well as purity and CCS % (not shown) responded in a similar manner. Ayub et al. (1999) obtained similar results in their research where sugarcane yields increased with the application of higher fertilizer rates, but there was no change in the CCS yields or any of the juice quality parameters.

The economics of NPK fertilization followed a pattern similar to cane yields (Table 3) with significantly higher net returns obtained with 150% and 175% RDF treatments in Manjari and Warna, respectively. Similarly, S, Fe, Zn and B (S4) gave the best economic response to fertilization at Manjari, while S, Fe, Zn, B, and Mn (S5) gave the best economic response at Warna. Thus, a balanced fertilization approach that included the site-specific application of secondary- and micro-nutrients proved superior to just the application of NPK alone.

Summary

Cane yields and net returns increased with NPK application beyond that currently recommended for sugarcane in

Abbreviations and notes: N = nitrogen; P = phosphorus; K = potassium; S = sulfur; Fe = iron; Zn = zinc; B = boron; Mn = manganese; CCS = commercial cane sugar; ₹ = Indian Rupee.
Maharashtra, but the response was site-specific. Cane yield response to secondary and micronutrient application also varied between the two locations. Commercial sugar yield and sugarcane juice quality parameters were not affected by any of the experimental approaches. In summary, a balanced approach that includes the site-specific application of macro- as well as secondary- and micro-nutrients is likely to meet the demands of modern sugarcane varieties and generate better results for growers.

**References**
