The Government of Saskatchewan helps make the International Section of this publication possible through its resource tax funding. We thank them for their support of this important educational project.

International Section

I N D I A

Most Profitable Sugarcane Production in Maharashtra

By D.B. Phonde, Y.S. Nerkar, N.A. Zende, R.V. Chavan, and K.N. Tiwari

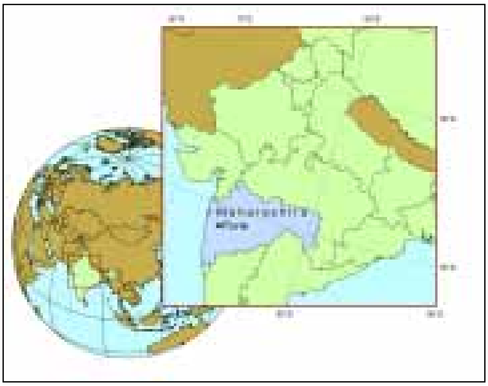
A comprehensive site-specific nutrient management (SSNM) strategy was by far the best option for plantations if compared to traditional farmer practice and available fertilizer recommendation systems.

The state of Maharashtra provides a clear example of a region which is falling considerably short of its sugar production potential. The region's climate is well-suited to sugarcane production. Its main limitations include a lack of emphasis on soil fertility through proper nutrient management.

Despite having higher fertilizer inputs than most of the surrounding states (excluding Andhra Pradesh), nutrient application rates can be considered low and imbalanced with total nitrogen (N), phosphorus (P), and potassium (K) consumption estimated at 88 kg/ha, consisting of an average application of 51-25-12 kg N-P_2O_5-K_2O/ha. Average sugarcane yields in Maharashtra hover around 90 t/ha. India's highest state-wise productivity of 108 t/ha occurs to the southeast in Andhra Pradesh, where average NPK consumption is higher at 80-33-16 kg/ha. Besides NPK deficiencies, emerging secondary and micronutrient deficiencies also provide significant constraints to high yields in Maharashtra. Little to no consideration is given to anything beyond the basic NPK needs of sugarcane and it is apparent that the potential of its production systems is largely being overlooked.

This study examined the available options for fertilizer recommendations (i.e., state fertilizer recommendation, state soil testing lab recommendation, typical farmer practice) and compared them with a SSNM strategy—a complete, soil analysis-based approach which fully considers all soil nutrient deficiencies and the corrective fertilization required to achieve a high yield goal.

A field experiment comprised of treatments outlined in **Table 1** was initiated in 2003 during suru season (January planting) at the Research and Demonstration Farm of Vasant Dada Sugar Institute, Pune. The test soil was described as a medium black clay. The initial soil analysis found low levels of available N, moderate P and K



The sugarcane research and education site is in Pune, Maharashtra.

Table 1. Treatments applied to sugarcane, Pune, India.

Treatment no.	N	P_2O_5	K_2O	S	Zn	Fe	Mn
	kg/ha				Sulfate salts, kg/ha		
State soil test	312	115	115				
State general	250	115	115				
Farmer practice	255	80	60				
T1	180	180	120	20	20	50	10
T2	180	120	120	20	20	50	10
T3	180	60	120	20	20	50	10
T4	180	0	120	20	20	50	10
T5	180	180	60	20	20	50	10
T6	180	180	0	20	20	50	10
T7	180	180	120	20	20	50	0
T8	180	180	120	20	20	0	10
T9	180	180	120	20	0	50	10
T10	180	180	120	0	20	50	10
T11	180	180	120	0	0	0	0

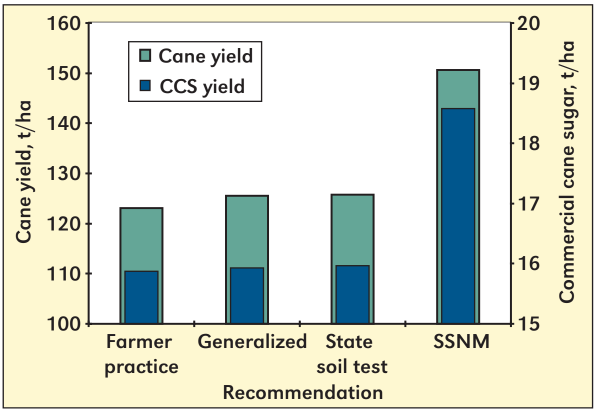


Figure 1. Effect of varying fertilizer recommendations on cane and sugar yield.

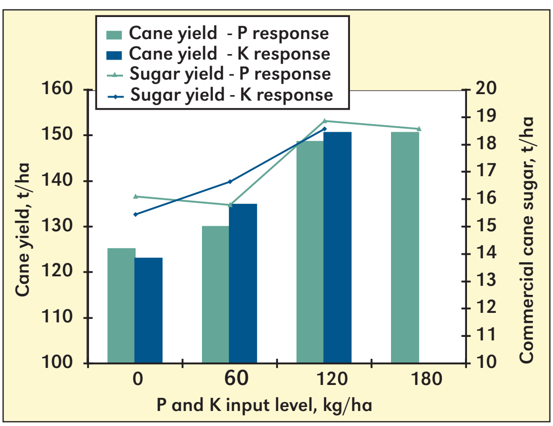


Figure 2. Effect of P and K levels on cane and sugar yield.

levels, and deficiencies for sulfur (S), zinc (Zn), iron (Fe), and manganese (Mn). Besides cane yield data, sugar recovery and relative economic benefit were calculated.

SSNM produced significantly higher yields compared to the generalized state recommendation, state lab soil test based recommendation, and farmer practice **(Figure 1)**. Cane yield was significantly influenced by both P and K (**Figure 2**). A yield of 150.6 t cane/ha was recorded with 180 kg P_2O_5/ha, but this was statistically equal to the 148.6 t/ha produced with 120 kg P_2O_5/ha. Yields produced with 0 and 60 kg P_2O_5/ha were 125 and 130 t/ha, respectively. The cane yield response to 0, 60, and 120 kg K_2O/ha appeared to be linear, suggesting that even greater productivity may be achieved under K application rates beyond 120 kg K_2O/ha.

Sulfur and micronutrients were an integral part of the SSNM package **(Figure 3)**. Cane yields were significantly higher with application of S, Zn, and Fe applications of 20, 20, and 50 kg/ha, respectively. The yield response to Mn applied at 10 kg/ha was not significant.

Juice quality indicators, including brix, pol, purity, and commercial cane sugar percentage (CSS%) were not significantly affected by any fertilizer application treatment (data not shown). However, as a result of the large cane yield increase due to SSNM, commercial cane sugar yield was highest at 18.9 t/ha, which greatly improved crop value.

Figure 4 illustrates the relative influence of individual nutrient omission on profitability. The highest benefit-to-cost ratio of 2.64 was provided with SSNM. The accrued benefit was reduced by 18, 29, 19, 20, 27, and 6%, if P, K, S, Zn, Fe, or Mn was omitted from the complete SSNM treatment.

Conclusion

Opportunity for maximum economic yield and improved sugar recovery is ensured through application of the principles of SSNM. The range of economic nutrient responses revealed the importance of considering secondary and micronutrients along with NPK fertilization. The generalized state fertilizer recommendation and even state soil testing lab recommendations are providing sub-optimal solutions for farmers and continue to promote low profitability. BC

Mr. Phonde and Dr. Zende are Scientists, Mr. Nerkar is Director, and Mr. Chavan is Research Associate, all with Vasant Dada Sugar Institute in Pune. Dr. Tiwari is Director, PPI/PPIC-India Programme, Gurgaon, Haryana; e-mail: kntiwari@ppi-ppic.org.

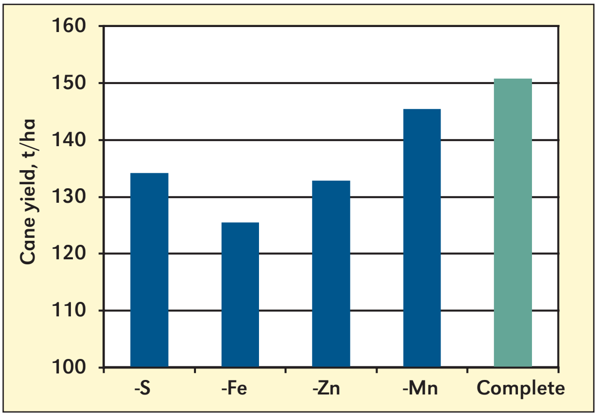


Figure 3. Effect of secondary and micronutrients on cane yield.

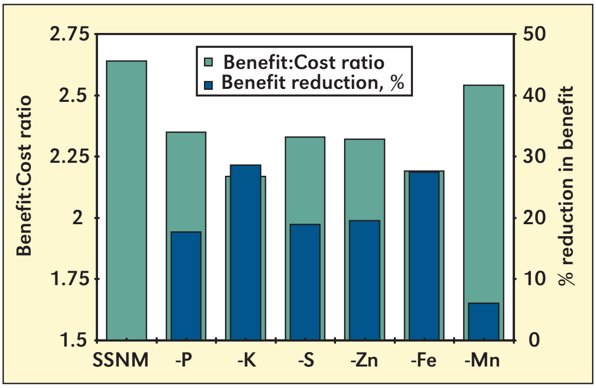


Figure 4. Cane yield profitability due to SSNM.

Correction for Table in *Better Crops* No. 2, 2005

In *Better Crops with Plant Food* Issue No. 2 of 2005 (Vol. 89), the unit indicated for free amino acids in Table 2 on page 26 was shown incorrectly. The table is part of the article titled "*Balanced Fertilization for Tea Production in Yunnan.*" The unit was indicated as **percent (%)**, but should be expressed as **mg/g**. The table with the corrected unit appears below.

Table 2. Treatment effect on amino acid, protein, and water extractable compounds in tea leaf tissue, Yunnan.

	Amino acid, mg/g			Protein, %			Water extractable compounds, %		
Treatment	Menghai	Simao	Eshan	Menghai	Simao	Eshan	Menghai	Simao	Eshan
1. $NP_1K_0S_1Mg_1Mn_1$	16.03	18.35	18.20	25.74	28.45	27.16	52.99	55.75	54.51
2. $NP_1K_1S_1Mg_1Mn_1$	17.93	19.19	18.41	24.91	28.33	27.48	53.05	56.45	54.72
3. $NP_1K_2S_1Mg_1Mn_1$	18.24	19.24	18.85	26.63	28.57	28.13	53.25	56.32	55.20
4. $NP_1K_3S_1Mg_1Mn_1$	17.11	18.31	17.01	23.97	27.82	26.92	53.90	56.91	55.24
5. $NP_2K_2S_1Mg_1Mn_1$	18.78	19.56	18.77	24.90	28.39	27.16	55.04	56.74	57.13
6. $NP_1K_2S_0Mg_1Mn_0$	16.64	19.01	19.20	25.57	28.67	27.92	53.11	56.29	56.82
7. $NP_1K_2S_1Mg_0Mn_1$	17.81	18.20	17.86	26.24	28.48	26.95	53.06	55.88	55.03
8. $NP_1K_2S_1Mg_1Mn_1$	17.71	19.89	21.98	25.57	28.26	27.32	54.26	56.33	56.60

Selected fertilizers were urea, monoammonium phosphate, single superphosphate, KCl, K_2SO_4 (treatment 8), gypsum, magnesium chloride, magnesium sulfate, and manganese sulfate.
Note: Only the Simao site received Mn, and no S.