*Bangladesh J. Sugarcane, 23 : 111-115* *July, 2001*

# Economics of Sugarcane Production as affected by Foliar Application of Micro-nutrients

**L.A. Jamali[1]; G.H. Jamro[1]; G.S. Khan; S.A. Sheikh[1] and A.G. Soomro[1]**
Suagr Crops Research Institute,
Mardan, NWFP, Pakistan

Received on 14.7.98

**Key words:** Micro-nutrients, foliar application, sugarcane.

Sugarcane (*Saccharum officinarum* L.) and its importance in the agrarian economics of the world needs no emphasis because of its higher values as a cash crop, as major source of sugar and as a source of basic raw materials for various agro based industries and enjoys a key position in the world economics. In Pakistan, sugar industry has extended to such extent that sugarcane has become main pillar of economic structure of the country. Inspite of fact that sugarcane plays a very important role in our economy, cane yield per unit area in Pakistan is much lower as compared to other sugarcane growing countries. The low yields may be attributed to low input resources, small farming units, consistency in traditional farming systems, natural climatic hazards, irrigation constraints, poor marketing and cane procurement system and unscientific pricing mechanism. Besides, all these factors, unawarness of farming community in respect of sugarcane requirements for various micro- nutrients is also a major cause for low yields in Pakistan. Micro-nutrients viz. Cu. Zn, B and Mn though required in lesser amounts for plant growth but are as essential as N, P and K because micro-nutrients play an important role in the absorption and translocation of major nutrients in plant. Banger *et al.* (1991) observed that application of $ZnS0_4$ beyond 50 kg $ha^{-1}$ significantly reduced cane yield. Li (1985) has reported best response of sugarcane variety CP-65/357 to zinc application in terms of cane yield and further reported that micro-nutrients requirement of sugarcane varied with variety, soil type, agro climatic conditions of an area and also plant have more demand for Mn, Zn and Cu at various growth stages. Gupta and Rao (1980) observed that application of Mn alone or in combination with Fe and B also significantly increased cane yield. Keeping in view the importance of micro-nutrients in sugarcane production, present study was undertaken to assess optimum dose of different micro-nutrients the economic yield of sugarcane under agro-climatic conditions of Mardan.

Experiments were conducted to assess optimum dose of different micro-nutrients for the economic yield of sugarcane variety CP-65/357 at Sugar Crops Research Institute, Mardan. The experiment was laid out in a randomized complete block design with thirteen treatments, replicated three times and each treatment consisted of seven rows 10 meters long with a row spacing of 90 cm. Phosphatic fertilizer (100 kg $P_20_5$ $ha^{-1}$) was applied as

[1] Sindh Agriculture University, Tando Jam, 70060, Pakistan;

basal dose before planting and nitrogen (175 kg N $ha^{-1}$) was applied in two split doses and other cultural practices were carried out uniformly in all treatments. Foliar application of micro-nutrients at requisite rates was made in two split doses, first dose was sprayed at 50 cm height of crop and second at height of 75 cm. The micro-nutrients were applied in the form of copper sulphate (25% Cu), zinc sulphate (22% Zn), boric acid (17% B) and manganese sulphate (26% Mn).

The treatments were, control 1.50, 3.00 and 4.50 kg Zn $ha^{-1}$, 0.50, 1.0 and 1.50 kg Cu $ha^{-1}$; 0.25, 0.50, 0.75 kg B $ha^{-1}$; 1.00, 2.00, 3.00 kg Mn $ha^{-1}$. The composite soil samples were collected at 0-45 cm and 45-90 cm depths at random from four different cores in experimental area each year. All diethylene triamine were made according to US Salinity Laboratory, Staff (1954), USDA Hand Book 60. Availabile Zn, Cu and Mn were determined by DTPA i.e. diethylene triamine pentaceptic acid method (Lindsay and Norvell,1978) and B was determined by method as described by Jackson (1958). The physical and chemical characteristics and metereological data are presented in the Table 1.

**Table 1. Physical and chemical properties of soil and metereological data of Sugar Crops Research Institute, Mardan.**

| Quality parameter | 1990 | 1991 |
|---|---|---|
| Physical and chemical Analysis Textural class of soil: Silt loam pH | 8.20 | 8.30 |
| O.M% | 0.83 | 1.00 |
| TSS (meq $L^{-1}$) | 117.00 | 120.00 |
| ECe (ds $m^{-1}$) | 0.23 | 0.25 |
| N (ppm) | 0.09 | 0.11 |
| Zn (ppm) | 21.00 | 23.00 |
| Cu (ppm) | 0.70 | 1.00 |
| B (ppm) | 0.11 | 0.16 |
| Mn (ppm) | 0.60 | 0.90 |
| Metereological Data | 1989-90 | 1990-91 |
| Mean maximum temperature ($^0$C) | 40.40 | 42.00 |
| Mean minimum temperature ($^0$C) | 2.30 | 0.40 |
| Rainfall maximum (mm) | 208.00 | 214.00 |
| Rainfall minimum (mm) | 2.50 | 6.05 |

Profitability of the fertilizer (micro-nutrients) was computed by using an indicator called "Value Cost Ratio" (VCR). The VCR is the ratio between value of additional crop yield and cost of fertilizer. Data recorded were statistically analysed according to methods outlined by Steel and Torrie (1980). The economic analysis for variance of sugarcane yield of two years as affected by micro-nutrients, along with net return (NR), value cost ratio (VCR) and statistical analysis of data are presented in the Table 2. Considering the average cane yield of two years, data clearly showed that cane yield was significantly increased by foliar application of micro-nutrients over the check treatments. The

interactions between years and micro-nutrients were also significant. Further results demonstated that among micro-nutrients, the highest average cane yield of 103.30 t $ha^{-1}$ was obtained from treatment receiving the lowest rate of Cu (0.50 kg $ha^{-1}$) with the highest average net return of Rs. 15343.15 $ha^{-1}$ (VCR value 154.43). The second highest average cane yield (102.01 t $ha^{-1}$) with a VCR value of 57.11 (net return of Rs. 14636.49 $ha^{-1}$) was obtained with 1.50 kg Zn $ha^{-1}$. Reduction in cane yield was observed with the higher rates of these elements. These results are in line with findings published elsewhere (Rahman *et al.* 1986; Kumaresen *et al.* 1987; Yadav *et al.* 1988; Ramanathan *et al.* 1989; Khattak and Jarrel, 1989; Verma *et al.* 1992). All these workers have reported that increase in cane yield with an adequate but not execessive application of Zn, Cu, Fe, Mg and Mn. Banger *et al.* (1991) also observed that application of $ZnS0_4$ beyond 50 kg $ha^{-1}$ significantly reduced cane yield.

Finally it can be concluded that foliar application of micro-nutrients was found effective over control. The lower rate of Cu (0.50 kg $ha^{-1}$) and Zn (1.50 kg $ha^{-1}$) performed better on net return respectively and further sugarcane showed a negative response to the increasing rates of Cu and Zn. While higher rates of Mn and B increased yield of crop than lower rates. The highest net return of Rs. 15343.15 with the highest value cost ratio of 154.43 was obtained from foliar application of (Cu 0.50 kg $ha^{-1}$) followed by Zn (1.50 kg $ha^{-1}$) and sugarcane crop showed a positive response in terms of yield return with all micro-nutrients.

**Table 2. Effects of foliar application of micro-nutrients on cane yield and economics of sugarcane variety CP-65/357 (Average of two plant crops of 1989-90 and 1990-91).**

| Treatments | Cane yield (t $ha^{-1}$) | Yield increase (t $ha^{-1}$) | Value of increased yield (Rs $ha^{-1}$) | Cost of micro-nutrients (Rs. $ha^{-1}$) | Net returns (Rs. $ha^{-1}$) | Value cost ratio (VCR) |
|---|---|---|---|---|---|---|
| Control | 66.80 | - | - | - | - | - |
| 1.50 kg Zn $ha^{-1}$ | 102.01 | 35.21 | 14897.35 | 260.86 | 14636.49 | 57.11 |
| 3.00 kg Zn $ha^{-1}$ | 85.14 | 18.31 | 7746.96 | 521.73 | 7225.23 | 14.85 |
| 4.50 kg Zn $ha^{-1}$ | 76.81 | 10.01 | 4235.23 | 782.59 | 3452.64 | 5.41 |
| 0.50 kg Cu $ha^{-1}$ | 103.30 | 36.50 | 15443.15 | 100.00 | 15343.15 | 154.43 |
| 1.00 kg Cu $ha^{-1}$ | 86.14 | 19.34 | 8182.75 | 200.00 | 7982.75 | 40.91 |
| 1.50 kg Cu $ha^{-1}$ | 85.69 | 18.89 | 7992.36 | 300.00 | 7692.36 | 26.64 |
| 0.25 kg B $ha^{-1}$ | 87.20 | 20.40 | 8631.24 | 90.91 | 8540.33 | 94.94 |
| 1.00 kg B $ha^{-1}$ | 84.19 | 17.39 | 7357.71 | 181.18 | 7175.90 | 40.47 |
| 1.50 kg B $ha^{-1}$ | 88.81 | 22.01 | 9312.43 | 272.72 | 9039.71 | 34.15 |
| 1.00 kg Mn $ha^{-1}$ | 77.88 | 11.08 | 4687.95 | 96.00 | 4591.95 | 48.83 |
| 2.00 kg Mn $ha^{-1}$ | 81.47 | 14.67 | 6206.88 | 192.00 | 6014.88 | 32.33 |
| 3.00 kg Mn $ha^{-1}$ | 85.44 | 18.64 | 7886.58 | 288.00 | 7598.58 | 27.38 |

Average price of sugarcane = Rs. 423.10 ton$^{-1}$; Zn = Rs. 173.91 kg$^{-1}$;Cu = Rs. 200.00 kg$^{-1}$; B = Rs. 363.63 kg$^{-1}$; Mn = Rs. 96.00 kg$^{-1}$

| | Average | |
|---|---|---|
| S.E. for years | = 1.28 t ha$^{-1}$ | L.S.D. (5%) = 3.64 t ha$^{-1}$ |
| | | " (1%) = 4.85 t ha$^{-1}$ |
| S.E. for micro-nutrient | = 3.27 t ha$^{-1}$ | L.S.D. (5%) = 9.28 t ha$^{-1}$ |
| | | " (1%) = 12.38 t ha$^{-1}$ |
| S.E. for years x micro-nutrients | = 4.62 t ha$^{-1}$ | L.S.D. (5%) = 13.14 t ha$^{-1}$ |
| | | " (1%) = 17.52 t ha$^{-1}$ |

## REFERENCES


Banger, K.S.; Sharma, S.R. and Sharma, R.K. 1991. Effect of iron and zinc on yield and quality of sugarcane. Indian Sugar, **41** (6): 403-404.

Gupta, A.P. and Rao, G.S.C. 1980. A study on effect of Mn on growth, total protein and nucleic acid in sugarcane plant. Proc. Int. Soc. Sugarcane Technol, **17**: 213-216.

Jackson, M.L. 1958. Soil chemical analysis. Prentice Hall, Inc. Engle-Wood Cliff. N.J. 372-374.

Khattak, R.A. and Jarrel, W.M. 1989. Effect of two soil moisture levels and wetting drying cycles on manganese release in NaCl soils. Comm. Soil Sci. Plant Analysis, **20** (1 and 2): 23-45.

Kumaresen, K.R.; Devarajan, R.; Savithria, P.; Manickam, T.S. and Kothandaraman, G.V. 1987. Need of micro-nutrient fertilization in increasing yield and quality of sugarcane. Madras Agric. J., **74** (8-9): 372-376.

Lindsay, W.L. and Norvell, W.A. 1978. Development of DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. Amer. J., **42** (3): 421-428.

Li, S.L. 1985. Combined application of different fertilizers to sugarcane. J. Soil Sci. Turang Tangbao, **16** (16): 156-158.

Ramanathan, G.N.; Nagasundaram, R.; Devarajan, P.S. and Ramadas, R. 1989. Correction of chlorosis in sugarcane crop. Sugar 21 (4): 253-255.

Rahman, M.H.; Chowdhury M.K.A.and Hussain, A.1986. Effect of sulphur on yields and sucrose content of sugarcane in calcarious and non-calcareous soils of Bangladesh. Proc. Intern. Symp. Dhaka, Bangladesh. **12**: 254-280.

Steel, R.G.D. and Torrie, J.H. 1980. Principles and procedures of statistics. A Biometrical Approach. McGraw Hill. Inc. 2nd Ed. New York. pp. 137-233.

U.S. Salinity Lab. Staff. 1954. Diagnosis and improvement of saline and alkaline soils. USDA Hand Book No. 60, Washington DC.

Verma, K.S.; Panna, B.S. and Sehtiya, H.L. 1992. Some observation on iron deficiency in sugarcane in Haryana. Indian Sugar, **47** (6): 369-372.

Yadav, D.V.; Yaduvanshi, N.P.S; Todi, S.; Kishan, S.; Singh, T. and Singh, K. 1988. Micro-nutrients Sugarcane Res., Lucknow. 226-002, India.