

Effect of lime on soil pH reaction and mulberry leaf productivity

S. K. MAJUMDER, R. KAR, R.N. DATTA, P.C. BOSE AND A. K. BAJPAI

Central Sericultural Research and Training Institute,
Berhampore-742101, Murshidabad, West Bengal

Acid soils occur in West Bengal mainly in (i) the western part of the state in the districts of Birbhum, Purulia, Bankura, Burdwan, West Midnapore and (ii) the northern tract of the state in the districts of Jalpaiguri, Coochbehar, West Dinajpur and also in the adjacent districts of Tirhut Division of Bihar (Mandal, 1976). Mulberry (*Morus* sp.) prefers almost neutral soil reaction for its luxuriant growth (Rangaswami *et al.*, 1976). Amelioration of acid soil through application of lime to enhance productivity of mulberry leaf as well as to improve soil reaction has been reported by Sarkar and Haque (1991). Similar report in West Bengal condition is yet to be available and, hence, two experiments were undertaken, one at Kashipur (Purulia) in red lateritic zone and another at Kishanganj (Tirhut Division of Bihar, adjacent to North of West Bengal) in tarai-teesta alluvial zone to recommend zone specific lime dose.

The experiments were carried out during 2001-03 in randomized block design with the mulberry (*Morus alba* L).var.S₁. Initial characteristics of the soils under experiments are presented in Table 1. Doses of lime as treatments were considered on the basis of estimated lime requirement values of soils under respective experiment following buffer depression method (Chopra and Kanwar, 1982). The lime requirement value of the soil determined under the experiment at Kishanganj was 10 t/ha while at Kashipur it was 2.5 t/ha. Treatments for the experiment at Kishanganj were employed as 2.50 t, 5.00 t and 10.00 t and for the experiment at Purulia were employed as 0.625 t, 1.250 t and 2.500 t of limestone per ha. Treatments were replicated for five times. The lime was applied in two equal splits, first, one month prior to and the second, two months after plantation for both the experimentations.

Plantation in both the places were done through saplings and were maintained as per the package of practices recommended for rainfed mulberry garden (Purohit, 1996). Leaf yield data were recorded after six months of plantation. Soil samples collected from each plot at different intervals, were analyzed for pH. (Jackson, 1973). Statistical analysis was also carried out. (Giridhar),

Application of lime had a marked influence on soil reaction and it was evident from Tables 2 and 3 that there had been a steady increase in soil pH upto certain period after the application of lime (210 days

for Kishanganj and 390 days for Kashipur), but gradually declined thereafter. However, increase in soil pH due to the application of lime was also reported by Dixit and Sharma, (1993) and Das *et al.*, (2006). The declining trend of soil pH after certain period of lime application may be due to the dominating effect of leaching resulting enormous exchangeable hydrogen ions and of hydrolytic acidity produced due to the presence of Al⁺³, Fe⁺³, Mn⁺² (Halder and Mandal, 1987) over neutralizing power of applied lime. Moreover, rapid declining trend of soil pH at Kishanganj may be explained in terms of its higher reserved acidity (Kar *et al.*, 1994) than Kashipur and the finding is further substantiated by higher ΔpH, higher CEC (Table 1) as well as higher lime requirement values of the former. It is interesting to note that soil pH (6.8), which is satisfactory for mulberry growth, has been found even after 390 days of lime application @ 10.00 t/ha at Kishanganj and after 480 days @ 2.500 t/ha at Kashipur (pH 6.4).

Progressive increase in leaf yield with the increment of lime doses had been observed in both the places (Table 4 and 5). Similar trend was observed earlier by Sarkar and Haque (1991) and Chatterjee *et al.*, (2005) in unlike agro-climatic condition. The benefit : cost ratio as mentioned in the above tables, differentiated the places for recommending economic dose of lime. The finding of the experiment at Kishanganj confirmed that the economics of mulberry leaf production was best with 2.50 t/ha lime application having the highest benefit : cost ratio (1.15:1.0) in alluvial zone. On the other hand, experiment under lateritic zone at Kashipur highlighted the lime dose of 0.625 t/ha as the most economic having the highest benefit : cost ratio (1.83:1.0). The findings prompted the authors to recommend the economic doses of lime @ 0.625 t/ha and 2.500 t/ha for the mulberry gardens grown in red laterite gravelly soil and tarai-teesta alluvial soil respectively.

REFERENCES

- Chatterjee, A., Dosani, A.K., Talashikar, S.C. and Mahta, V.B. 2005. Effect of lime on yield, quality and nutrient uptake by six groundnut varieties and properties of an Alfisol. *J. Indian Soc. Soil Sci.*, 53 : 128-32

- Chopra, S.L. and Kanwar, J.S.1982. *Analytical Agricultural Chemistry*, Kalyani Publishers, New Delhi. Chowdhury, S.N. and Bordoloi, D.N. 1993. Influence of liming on nutrient uptake and yield of palmarosa (*Cymbopogon martini*, Var. motia). *Indian J. Agron.*, **38** : 618-621.
- Das, P.K., Sahu, S.K. and Sarangi, D. 2006. Effect of pH and lime on sulphate adsorption in some Alfisols of Osissa. *J. Indian Soc. Soil Sci.*, **54** : 283-89
- Dixit, S.P. and Sharma, P.K. 1993. Effect of lime and potassium on soil acidity, forms of aluminium and iron and yield of crops in a sequence. *J. Indian Soc. Soil Sci.*, **41** : 522-26.
- Halder, B. R. and Mandal, L.N. 1987. Effect of calcium carbonate on exchangeable Al content and availability of some nutrient cations in an acid soil of Assam under water logged condition. *J. Indian Soc. Soil Sci.*, **35**: 35-40.
- Jackson, M.L. 1973. *Soil Chemical Analysis*, Prentice-Hall of India Pvt. Ltd., New Delhi.
- Kar, R., Majumder, S.K., Datta, R.N. and Sen, S.K.1994. Mulberry cultivation in the acid soils of Bihar and West Bengal. *Indian Silk*, **33** : 19-21.
- Mandal, L.N. 1976. Acid soils in eastern India. In: Acid soils of India-their genesis, characteristics and management. *Bulletin No.11, Indian Soc. Soil Sci.*, New Delhi, pp.19.
- Purohit, K.M. and Pavan Kumar, T.1996. Influence of various agronomical practices in India on the leaf quality in mulberry- a review. *Sericologia*, 36:27-39.
- Rangaswami, G., Narasimhanna, M.N., Kasiviswanathan, K., Sastry, C.R. and Jolly, M.S. 1976. Mulberry Cultivation. In: *FAO Sericulture Manual*, Rome, pp.43.
- Sarkar, A.A. and Haque, M.T.1991. Effects of lime and ash on the physico-chemical characteristics of an acid soil and leaf yield of mulberry. *Bull. Seric. Res.*, **2** :1-6.
- Wiklander, L. 1960. *Trans. 7th Intern. Cong. Soil Sci.*, Madison, pp. 283.

.Table 1. Initial characteristics of soil under experiments

Characteristics	Locations of the experiments	
	KIshanganj	Kashipur
Sand (g100 ⁻¹ g)	57.70	64.62
Silt (g100 ⁻¹ g)	10.00	12.18
Clay (g100 ⁻¹ g)	25.00	19.75
Texture	Sandy clay loam	Sandy loam
Water holding capacity (%)	46.27	28.31
Bulk density (g. cm ⁻³)	1.27	1.42
pH (1:2.5) H ₂ O	5.20	4.95
pH KCl(1N)	3.95	4.15
ΔpH (pH H ₂ O - pH KCl)	1.25	0.80
CEC(cmoles kg ⁻¹)	7.37	3.15
Organic carbon (G100 ⁻¹)	0.69	0.36
Available nitrogen(kg ha ⁻¹)	257	246
Available phosphorus (kg ha ⁻¹)	32	20
Available potassium (kg ha ⁻¹)	130	210
Total nitrogen (%)	0.10	0.056
C:N ratio	6.90	6.4

Table 2. Influence of lime on soil reaction at Kishanganj

Level of lime application (t.ha ⁻¹)	Initial pH	pH at different days after liming			
		120	210	300	390
Control	5.2	5.2	5.1	5.0	4.9
2.5	5.2	5.5	6.2	5.8	5.4
5.0	5.2	5.7	6.5	6.2	5.8
10.0	5.2	5.8	7.8	7.6	6.8

Table 3 . Influence of lime on soil reaction at Kashipur

Level of lime application (t.ha ⁻¹)	Initial pH	pH at different days after liming				
		120	210	300	390	480
Control	4.95	4.95	4.95	4.85	4.80	4.70
0.625	4.95	5.10	5.35	5.45	6.20	6.10
1.250	4.95	5.20	5.63	5.67	6.50	6.10
2.500	4.95	5.30	5.82	6.09	7.05	6.40

Table 4. Effect of lime application on leaf yield of mulberry grown at Kishanganj and its economics

Levels of lime application (t.ha ⁻¹)	Leaf yield (kg/ha)	% increase over control	Benefit :cost ratio
Control	9840.79	-	-
2.50	14094.46	41.19	1.15:1.0
5.00	14932.37	51.74	0.55:1.0
10.00	15880.12	61.37	0.40:1.0

CD (P=0.05) 2101.88*

Cost of lime: Rs 3.00/- per kg ; Cost of leaf : Rs 2/- per kg

Table 5. Effect of lime application on leaf yield of mulberry grown at Kashipur and its economics

Levels of lime application (t.ha ⁻¹)	Leaf yield (kg/ha)	% increase over control	Benefit :cost ratio
Control	10323.65	-	-
0.625	12019.44	16.43	1.83:1.0
1.250	13285.50	28.69	1.60:1.0
2.500	14260.57	38.13	1.06:1.0

CD (P=0.05) 1423.57*