Widespread Zinc and Other Deficiencies in the Rainfed Semi Arid Tropics of India: Soil Maps as Tools to Delineate and Manage Deficient Regions

K.L. Sahrawat, S.P. Wani, Girish Chander, G. Pardhasaradhi, M.I. Ahmed

Resilient Dryland Systems, ICRISAT, Patancheru 502324, Andhra Pradesh, India (s.wani@cgiar.org; k.sahrawat@cgiar.org; g.chander@cgiar.org)

INTRODUCTION

Apart from water shortages, the productivity in rainfed systems of semi arid India is low due to poor fertility status of the soils (Sahrawat et. al., 2010). However, little effort has been made to diagnose and manage the nutrient related problems in farmers' fields and the usual practice of applying sub-optimal amounts of nitrogen (N), phosphorus (P) and potassium (K) continues in rainfed farming. For a sustainable increase in rainfed productivity, the issues related to soil fertility need to be addressed on priority. The first objective of this communication is to show how soil testing can be used to diagnose and manage nutrient problems in the farmers' fields. The other objective is to prepare nutrient maps using the GIS and delineate deficient regions from sufficient ones for use by farmers and other stakeholders.

METHODS

Soil samples were collected from farmers' fields in Karnataka, Andhra Pradesh, Rajasthan, Madhya Pradesh, Tamil Nadu and Gujarat states of India following stratified random sampling method standardized earlier to sample watersheds (Sahrawat et al., 2008). Soil samples were analysed for organic carbon (OC) and available zinc (Zn), boron (B), sulphur (S), P and K using standard methods (Sahrawat et. al., 2010). Available Zn was determined by diethylene triamine pentaacetic acid (DTPA) method (Lindsay and Norvell, 1978). With the help of GIS, the analysis results were used in developing soil maps for Zn and other parameters for selected districts of Karnataka, India. Soil test results were shared with participating farmers and other stakeholders through wall writings, village meetings, soil health cards and internet etc.

RESULTS AND DISCUSSION

The results of analysis of selected soil samples collected from semi arid regions of India showed that the majority of farmers' fields were low in soil OC in Karnataka, Andhra Pradesh and Tamil Nadu states (Table 1). Soil OC is an indicator of general soil health, and specifically of available N. Similarly, P tested low in a majority of farmers' fields in Madhya Pradesh, Tamil Nadu and Gujarat. Across all states, the majority of fields were, in general, adequate in K (Table 1). Low soil test values for Zn were widespread in all states, except in Rajasthan. The percentage of farmers' fields testing low in Zn ranged from 46% in Rajasthan to 85% in Gujarat. Similarly, the perentage of fields testing low in B ranged from 56 to 100% and for S from 46 to 83% (Table 1).

We have prepared maps showing soil nutrients status including Zn for 15 dryland districts of Karnataka. Typical results on soil Zn status for two districts in Karnataka are included here as an example. A large contiguous tract of land deficient in Zn was identified across Bagepalli and Gundibanda blocks in Chikballapur district (Fig. 1). Other blocks viz. Gauribidanur and Chintamani in Chikballapur district also had pockets potentially deficient in Zn. The results also showed that almost all blocks in Chitradurga district were critically deficient in Zn (Fig. 2).

Table 1. Soil test results of farmers' fields in different states of India.

State	No. of Dists.	No. of Farmers	% classed as low					
			OC	Av-Zn	Av-B	Av-S	Av-P	Av-K
Karnataka	16	33200	66	57	66	83	45	14
Andhra Pradesh	11	3650	76	69	85	79	38	12
Rajasthan	9	421	38	46	56	71	45	15
Madhya Pradesh	12	341	22	66	79	74	74	1
Tamil Nadu	5	119	57	61	89	71	51	24
Gujarat	1	82	12	85	100	46	60	10
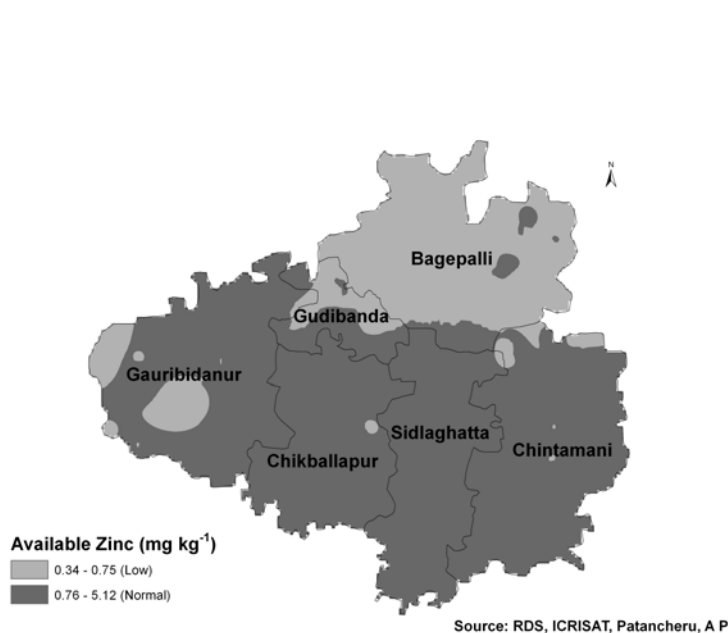
Fig. 1. Zn map for Chikballapur district
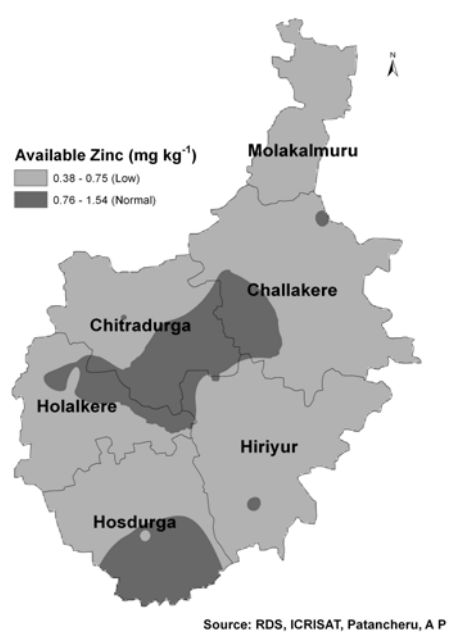
Fig. 2. Zn map for Chitradurga district

CONCLUSIONS

The results showed widespread low soil test values for Zn, B and S in rainfed farming systems. Soil test results can be used for preparing nutrient maps for informed decisions about balanced nutrient management in farmers' fields.

REFERENCES

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

Sahrawat, K.L., Rego, T.J., Wani, S.P., Pardhasaradhi, G. (2008) Stretching soil sampling to watershed: Evaluation of soil-test parameters in a semi-arid tropical watershed. *Commun. Soil Sci. Plant Anal.* 39: 2950-2960.

Sahrawat, K.L., Wani, S.P., Pardhasaradhi, G., Murthy, K.V.S. (2010) Diagnosis of secondary and micronutrient deficiencies and their management in rainfed Agroecosystems: Case study from Indian semi-arid tropics. *Commun. Soil Sci. Plant Anal.* 41: 346-360.