Potassium Status of Soils in India

By Rehanul Hasan

Soil test results for potassium (K) fertility status among India's agricultural soils are categorized accordingly: 21% low, 51% medium, and 28% high. Thus, 72% of India's agricultural area, representing 266 districts, needs immediate K fertilization.

Soils rated as high can show significant responses to applied K in certain soil, crop, and climatic situations. Thus, soil test methods for categorizing soils into low, medium, and high K values need further refinement for better soil test/crop response correlation. A serious attitude towards K application is still lacking among farmers and extension workers. There is an urgent need to educate both about the importance of K in Indian agriculture for nutrient balance and efficiency, top crop yields and quality, and farmer profitability.

Since the arrival of high-yielding varieties (HYVs) of foodgrains in the 1960s, tremendous progress has been made in fertilizer use and agricultural production. Higher production of food, fibre, and other crops also results in much higher removal of nutrients from soils. Clearly, expansion in fertilizer application (input) continues to fall short of nutrient removal (output), resulting in depletion of soil fertility and negative nutrient balance. The situation cannot go on forever and strikes at the very root of sustainable agriculture.

Potassium is one of the three main pillars of balanced fertilizer use, along with nitrogen (N) and phosphorus (P). While India is the third largest

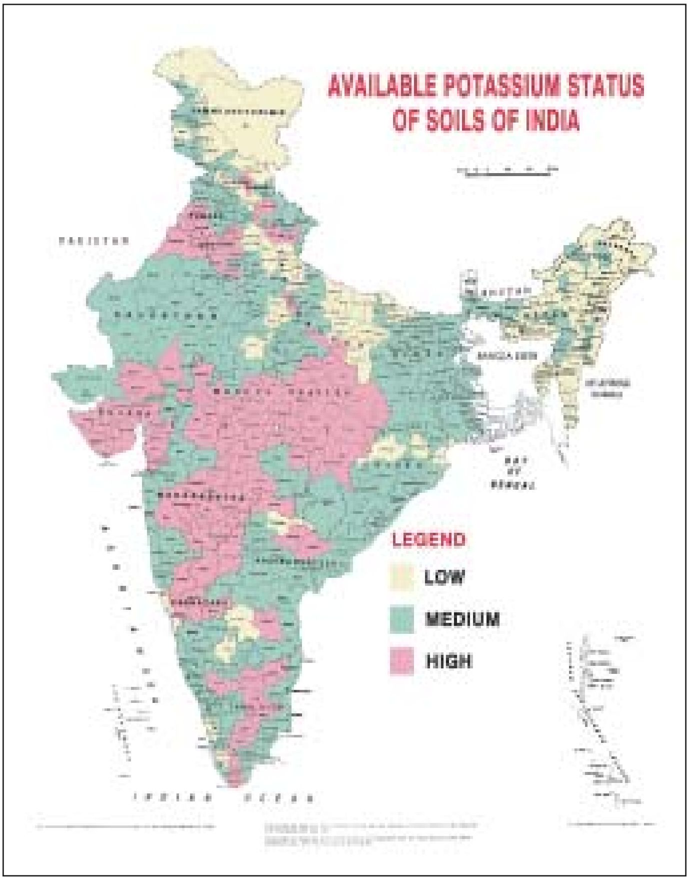

Figure 1. Nutrient index values for India indicate that 21% of districts are low, 51% are medium, and 28% are high in K fertility.

Table 1. Number of districts categorized as having low, medium, and high K-fertility status.

State	Low	Medium	High
Andhra Pradesh	2	14	3
Arunachal Pradesh	2	3	0
Assam	7	3	0
Bihar & Jharkhand	1	24	2
Chandigarh	0	1	0
Dadra & Nagar Haveli	0	1	0
Delhi	0	1	0
Goa	1	0	0
Gujarat	0	3	16
Haryana	0	2	9
Himachal Pradesh	6	4	3
Jammu and Kashmir	5	5	0
Karnataka	3	10	7
Kerala	4	6	0
Madhya Pradesh & Chhatisgarh	3	10	31
Maharashtra	0	12	13
Manipur	1	0	0
Meghalaya	1	0	0
Mizoram	1	0	0
Nagaland	5	0	0
Orissa	2	11	0
Punjab	0	9	3
Pondicherry	1	0	0
Rajasthan	0	23	3
Sikkim	0	4	0
Tamil Nadu	0	6	7
Tripura	3	0	0
Uttar Pradesh & Uttaranchal	26	23	7
West Bengal	2	13	1
Total districts, (%)	**76 (21)**	**190 (51)**	**105 (28)**

user of NPK fertilizers in the world, with current annual consumption at about 18 million tonnes (M t) of N + P_2O_5 + K_2O, K constitutes only one-seventh of the total.

Higher crop K requirement comes with higher crop yields. Potassium's importance in plant growth and development has been known for over 150 years. Most crops take up as much or more K than N. About 70 to 75% of the K absorbed is retained by leaves, straw, and stover. The remainder is found in harvested portions such as grains, fruits, nuts, etc. Whenever the soil cannot adequately supply the K required to produce high yields, farmers must supplement soil reserves with fertilizer K. It is necessary to continually emphasize the role and importance of K in crop production as balanced fertilizer use has a direct bearing on the country's capability to produce its ever-increasing requirement of food, fibre, and other farm-based commodities. Improvements in both quantity and quality will add to export earnings.

Information presented here is based on more than 11 M soil samples made available by soil testing laboratories run by state departments of agriculture and the fertilizer industry. Part of the data originates from technical reports published by state departments of agriculture and publications appearing in scientific journals during the last two decades. Though 11 M soil tests are not sufficient to comprehensively cover a country which has more than 140 M cultivated ha, they reflect changing K fertility status of soils in different parts of the country and provide some measure of need for scientific use of K fertilizers.

Available soil K was extracted with 1N ammonium acetate (NH_4OAc, pH 7.0) and soils containing less than 130 kg K_2O/ha were categorized as low, between 130 and 335 kg K_2O/ha as medium, and above 335 kg K_2O/ha as high. State-by-state available K status is given in **Table 1.** The map and distribution of districts considered low, medium, and high in K fertility (**Figure 1**) show that out of 371 districts for which information is available, the respective number of districts characterized as low, medium, and high are 76, 190, and 105, respectively. Thus, 21% of the districts are low, 51% are medium, and 28% are high, using the nutrient index values suggested by Ramamurthy and Bajaj (1969). (A complete listing of districts in low, medium, and high categories is available but not included here.)

Comparing these results with those presented earlier by Ghosh and Hasan (1980), the low and high categories have decreased by 0.6 and 6.4%, respectively, while the medium category increased by 7%. All this indicates that K fertilizers were scantily applied in the last two decades as the low category has virtually remained the same and the high area has fallen.

Lack of farmer awareness about the importance of K indicates need for more education. For example, farmers may not realize the effect of applied K on the size, shape, color, and quality of produce at maturity, so its need may be overlooked. In contrast, the benefits from N and P are more readily apparent from initial stages of crop growth. Another reason for inadequate use of K fertilizers may be the lack of crop response to applied K, even on low K testing soils. However, significant responses to applied K may be noted in high K soils. To overcome such anomalies, intensive research is needed at national and state levels to consider total K, exchangeable and non-exchangeable K, and K-fixing capacity of the soils under different soil-crop-climatic conditions.

An increasing number of farmers throughout India want to produce top yields and high net returns. Understanding soil nutrient status and corrective fertilizer management practices to support high yields of high quality crops requires a continuation of scientific information and broadly based education programs for the farm advisory service, soil and plant testing laboratories, trainers, the mass media, and ultimately the farmer. **BCI**

Dr. Hasan was Principal Scientist (retired), Division of Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute (IARI), New Delhi-110012.

Acknowledgments

The author gratefully acknowledges the cooperation rendered by the officer in-charge of soil testing laboratories in the country, directors of agriculture in the states, vice-chancellors, heads of departments of soil science and agricultural chemistry of the state agricultural universities, and the fertilizer industry. Thanks also to past and present directors of IARI for their encouragement of this publication and the soil fertility map of the country, and to colleagues at IARI and PPIC for their help and constructive suggestions.

References

Ghosh, A.B. and R. Hasan.1980. Soil Fertility Map of India, Indian Agricultural Research Institute, New Delhi.

Ramamurthy, B. and J.C. Bajaj. 1969. Soil Fertility Map of India, Indian Agricultural Research Institute, New Delhi.