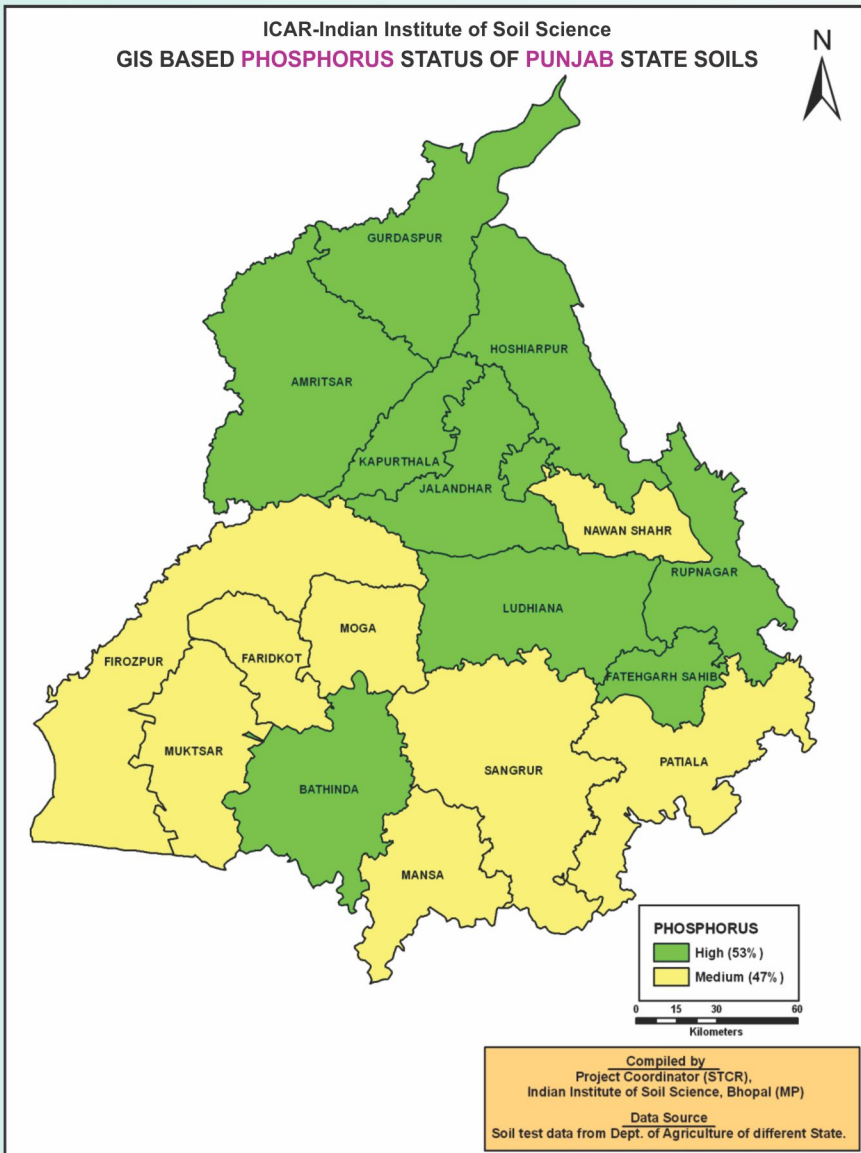


A Success Story on Reutilization of Accumulated Soil Phosphorus: Lessons Learnt from AICRP LTFE



Developed By

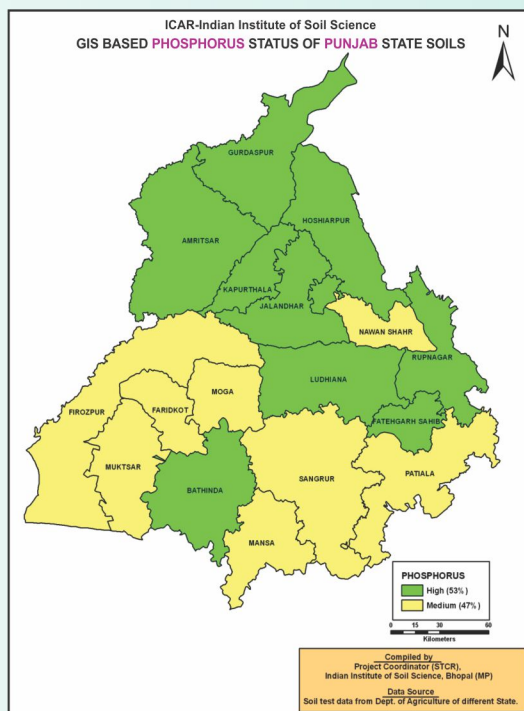
All India Coordinated Research Project on
Long-Term Fertilizer Experiments to Study Changes in Soil Quality,
Crop Productivity and Sustainability



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FERTILIZER NUTRIENTS are important for sustaining the soil productivity. Phosphorus (P) has more pronounced effect on root development, nodulation, growth and yield sustainability of many crops. In addition to these benefits, it plays an important role in energy transfer reactions and in oxidation-reduction processes. To study the sustainable soil productivity long term fertilizer experiments (LTFE) are in progress since 1971 across major agro-ecological zones covering important soil types and predominant cropping systems of the country. Analysis of data generated under AICRP-LTFE across the different soil types revealed that continuous application of phosphate fertilizer in various crops and cropping systems increased soil P status. But the magnitude of P accumulation was different in different soil types. Increase in soil P status was more in alluvial and acids soils, and was relatively less in Vertisols. Farmers were also using P fertilizer in more or less in similar way especially in intensively cultivated area. Survey carried out in Ludhiana (Punjab) and adjoining districts confirmed the findings. Therefore phosphorus management strategy has to be modulated to reutilize the accumulated P by reduction in P dose to half or skipping of P from the fertilizer schedule of the kharif crops.



It was noted that soil P status in most of soil samples collected from farmer's field were also in the range of high to very high. Therefore, a strategy was developed and tested in experimental field to reutilize accumulated P and to avoid adverse effect on environment. A main plot (100% P) was sub-divided into 100% P and 50% P, to study the residual effect of reduced P dose. The yield data revealed that as a result of reduction of P dose to half did not have any adverse effect on crop productivity of either maize or wheat. At the same time similar strategy was implemented in farmer's field also and found the similar kind of yield trend and there was no reduction in crop productivity. To further strengthen our findings, P status in soil was measured and noted that continuous use of 100% P in both crops resulted in increase in P status in soil @ 1 ppm every year. Whereas, reduction in P application to half resulted decline in soil P status to 0.46 ppm (Table 1).

Table 1. Dynamic in soil Olsen's P with time and impact of P dose to half on crop productivity

Treatment	P status (mg kg ⁻¹ yr ⁻¹)		P rate (mg kg ⁻¹ yr ⁻¹)		Av. Yield (t ha ⁻¹)	
	1994	2006	Increase	Decrease	Maize	Wheat
100% NK +100% P	34.3	41.1	1.07	-	5.83	5.64
100% NK + 50% P	-	28.7	-	-0.46	5.72	5.59
CD (P≤0.05)	-	-	-	-	0.20	0.15

Initial P = 4 mg kg⁻¹; *45 farmers

Field Demonstrations

Demonstrations on farmers' fields carried out in the districts of Ludhiana, Jalandhar and Nawanshahr of Punjab for three years and the soil analysis data obtained indicated that there is no reduction in crop productivity (Table 1). In this direction, a strategy was recommended to use 100% P in rabi crop and kharif should be grown on residual P. The moisture availability and high temperature during kharif will take care of mobilization of residual P. A part of accumulated P will be reutilized by the kharif crops. On the basis of results, recommendation was made to farmers through package of practices. Which is being used by the farmers and similar strategy is being followed in the adjoining part of Haryana and western Uttar Pradesh. Phosphorus status of Punjab is given (Map & Table 1) and soil P status varied from high to medium and getting stable yield with a developed P reutilization strategy.

Saving of P-Fertilizer

The details of fertilizer required to be used, being used and the saving in fertilizer is given in Table 2. Thus by using the strategy developed for P fertilization in intensively cultivated part of Northern India saved P fertilizer worth Rs. 50976 million is being saved since last two years.

Table 2. Area and phosphate fertilizer used under rice-wheat, maize- wheat and cotton-wheat in three northern states

States	Area (million ha)	Requirement (million tons)	Being used (million tons)	Fertilizer Saving (million tons)	Saving in million Rs.
<i>Punjab</i> ^a					
Rice/maize/cotton-wheat	6.906	0.554	0.389	0.165	8910
<i>Haryana</i> ^b					
Rice-wheat	4.37	0.349	0.226	0.123	6642
<i>Uttar Pradesh</i> ^c					
Rice-wheat	16.32	1.304	0.646	0.656	35424
Total	27.56	2.207	1.261	0.944	50976

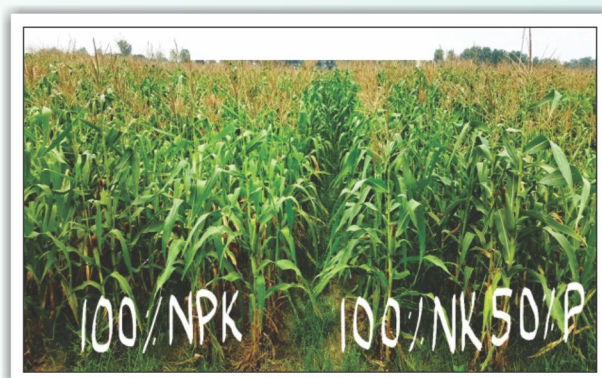
Note: Estimate denotes P fertilizer @ Rs 54000/ per ton (Source: FAI 2014-15); Area and P consumption from (a) Punjab - Region Profile (web: sap.ipni.net/article/Punjab) (b) Haryana Region Profile (web: sap.ipni.net/article/haryana) and (c) Uttar Pradesh Region Profile (web: sap.ipni.net/article/uttarpradesh)

Conclusion

On implementation of the strategy developed out of the research of long term fertilizer experiment there is a saving of nearly one million tons of fertilizer P worth Rs 5000 crores every year in Haryana, Punjab and western part of Uttar Pradesh. A similar strategy can also be applied in intensively cultivated area of Karnataka, Andhra Pradesh, Telangana, Tamil Nadu and West Bengal and also in acid soil region where accumulation of P is very fast.

Impact on growth of maize after reducing P dose to half

in long term fertilizer experiment at Ludhiana



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