

Consumption coefficient of phosphorus by some crops in the soils of Jaunpur District (U.P.) India

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ABSTRACT

Through the intensive use of fertilizers green revolution has been successful in increasing agricultural production but the spot of ground where the corn and plants grew has changed beyond recognition. In the race of producing more food at any cost, soils in countries like India has badly deteriorated. Industrialization, urbanization and infrastructural developments have reduced agricultural land to a significant extent which is to be compensated by excessive use of fertilizers. Crops according to their nature consume a fraction of nutrients applied to the field while the rest causes soil and water pollution.

In the present investigation an attempt has been made to assess the consumption coefficient of phosphorus by two common crops. i.e. maize (*Zea mays*) and paddy (*Oryza sativa*).

Key words: Consumption coefficient, Phosphatic fertilizers.

INTRODUCTION

Fertilizers are the organic or inorganic materials of natural or synthetic origin which are added to the soil to supply certain elements essential to the growth of plants. In order to supply the nutrients in a readily available form to the plants, fertilizers and manures are used. Nitrogen, phosphorus and potassium are required by the plants in large amounts and are therefore designated as major or primary nutrients. In phosphate fertilizers, phosphorus is present in the form of phosphate or superphosphate salt and is available to the plants when it is combined with organic matter or with Ca or Mg. Phosphorus has often been called "master key to agriculture" as low crop production is due more often to a lack of phosphorus¹ than to the deficiency of any other element except nitrogen. It is also found in combination with Fe and Al is

present in certain rock minerals as apatite. Plants take up phosphorus chiefly as PO_4^{3-} , HPO_4^{2-} and H_2PO_4^- ions and availability of these ions depend chiefly upon the acidity of the ground. They become nearly insoluble in strongly acidic or strongly alkaline soils. The breakdown of phosphatic fertilizers produces phosphoric acid in soluble form that is absorbed by plant. Different crops intake phosphorus consumed by the crops is designated by 'consumption coefficient' which depends upon the mode of assimilation of nutrients by the plant. Phosphorus plays an important role in energy transformation and participates in fat and protein metabolism. The most obvious effect²⁻⁴ of phosphorus is on the root system of plants. It promotes and participates in lateral and fibrous roots which increases the absorbing surface for nutrients. It is essential for seed formation. Phosphorus gives strength to the straw and helps

to prevent lodging. Phosphorus increases disease resistance in plants, presumably due to normal cell development and resulting vigorous growth. Leguminous crops grown under phosphate deficiency conditions may suffer from nitrogen deficiency as well, since the nodule bacteria function normally only when plants are supplied with adequate phosphorus. Each organic and inorganic forms of phosphorus occur in soil and both are important to plant as sources of this element⁵⁻⁶. Over application hastens ripening but may so reduce the length of the growing period as to reduce productivity.

Keeping in view the unbalanced use of fertilizers and also creating awareness among the farmers, the present work was undertaken for making better soil conditions for farming and to reduce pollution as low as possible.

MATERIAL AND METHODS

The areas under study comprise Badlapur tahsil of Jaunpur district (U.P.). The soil of the experimental site is almost sandy clay. The average pH of the soil is 5.59 showing the acidic character of soil. The Olsen's method⁷ was taken in practice

Table 1: Precent consumption of phosphorus in different crops and its residual values

Investigated areas	Total number of soil samples	Average of soil samples	Pre-sowing concentration kg ha ⁻¹	Pre-sowing concentration kg ha ⁻¹	Consumed phosphorus kg ha ⁻¹	Percent consumption
Arjunpur						
a-Paddy	30	5.26	80.25	65.64	14.61	18.20
b-Maize	30	5.26	80.25	63.99	16.26	20.25
Kachhaura						
a-Paddy	35	5.70	82.45	69.46	12.99	15.75
b-Maize	35	5.70	82.45	64.18	18.27	22.15
Ratasi						
a-Paddy	25	5.82	85.75	66.79	18.96	22.10
b-Maize	25	5.82	85.75	65.64	20.11	23.45
Baharipur						
a-Paddy	40	5.56	84.62	67.69	16.93	20.35
b-Maize	40	5.56	84.62	66.55	18.07	21.35
Mahada						
a-Paddy	25	5.62	81.35	67.15	14.20	17.45
b-Maize	25	5.62	81.35	60.93	20.42	25.10
Average values						
a-Paddy	-	5.59	82.88	67.34	15.54	18.77
b-Maize	-	5.59	82.88	64.26	18.62	22.46

for the assessment of residual phosphorus content of the soil on adding phosphatic fertilizer before sowing and after harvesting the crop.

RESULTS

Calculations

The average area of each village under conditions is 27 hectare. Hence total area covered by all these five villages will be = $27 \times 5 = 135$ ha. About 50% of the total area is covered by gardens, house, barrel land and other cultivated crops and remaining 50% is cultivated by paddy and maize. Hence, $135/2 = 67.5$ ha.

Among the total area about 60% area is cultivated by paddy and 40% by Maize.

Hence

$$\frac{67.5}{100} \times 60 = 40.50 \text{ ha}$$

$$\frac{67.5}{100} \times 40 = 27.00 \text{ ha}$$

Now, since 67.34 kg/ha phosphorus remains unconsumed by paddy and 64.26 kg/ha by maize. Hence, total unconsumed phosphorus by paddy crop cultivated over 40.50 ha = $67.34 \times 40.50 = 2727.67$ kg.

Similarly total unconsumed phosphorus by maize crop.

Cultivated over 27.0 ha = $64.26 \times 27.0 = 1735.02$ kg
Grand total = $2727.67 + 1735.02 = 4462.69$ kg

Hence, unconsumed phosphorus/ha = $4462.69/67.5 = 66.12$ kg/ha.

DISCUSSION

Data in Table 1 reveal that in Arjunpur, Kachhaura, Ratasi, Baharipur and Mahada villages the percentage of phosphorus consumed by paddy and maize are 18.20, 15.75, 22.10, 20.35, 17.45

and 20.25, 22.18, 23.45, 21.35, 25.10 respectively. The average percent consumption of these nutrients per hectare area found to be 18.77 and 22.46 kg separately. Thus through these two crops only the average percent contribution of phosphorus to the soil becomes 79.38 kg ha^{-1} , which is significantly large and may lead to a high degree of pollution in soil, water, grain and fodder.

Besides the positive effects of fertilizers use, the negative aspects which are often overlooked must be addressed with special attention to the environmental issues⁸. Thus, mineral and organic fertilizers are often accused of leading to the accumulation of dangerous or even toxic substances in soil from fertilizers constituents e.g. Cd from mineral phosphatic fertilizer in ground water, adversely affects the quality of drinking water, as unwanted enrichment of the atmosphere with ammonia from organic manures and mineral fertilizers and with N_2O from identification of excessive or wrongly placed fertilizer, thereby contributing to global warming.

As far as the biodiversity is concerned, inefficient use, overuse and abuse of fertilizers cause considerable ecological loss to the nation and the farmer. Thus, among the farmers if adequate awareness is not developed, there will be extravagance on one hand and terrible pollution hike on the other hand causing health hazards to the poor villages. It is also remarkable that small scale farming contributes larger share of phosphorus pollution of India the small scale farming will dominate upon the large scale farming evolving a greater prospect of pollution leading the situation from bad to worse

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