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POTASSIUM REMOVAL FROM THREE ALLUVIAL SOILS BY GREENHOUSE AND LABORATORY PROCEDURES

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A pot experiment was conducted on the Shahdara, Nabipur and LyaUpur soil series to study the relationship between potassium uptake by wheat cv. LU26S and the amount extracted by various extractants, like ~20,lN N~40Ac, 0.5N MgOAc, 0.025N $CaCl_2$ and IN HNO)';l Nitrogen at the rate of 0, 150 and 200 kg N ha and pj1osphorus at the rate of 0, 44 and 66 kg P ha were applied. The highest correlation (r = 0.984) between IN $NH_4$0Ac extractable potassium and plant uptake was obtained when no NP fertilizers were applied while 0.025 N $CaCl_2$ gave the highest correlations of r = 0.936 and r = 0',815 for $N_{150}P_{44}$ and $N_{200}P_{66}$ treatments, respectively.

INTRODUCTION

There have been many attempts to characterize the nutrient supplying power of soils by simulating the feeding action of plant roots and through determining the available fraction of nutrients during the vegetative growth (Soltanpour and Schwab, 1977). There is a general consensus that most of the cultivated soils in Pakistan have sufficient supply of available potassium for plant growth because of the dominance of Elite clay mineral (Ranjha, 1988). However, under intensive cropping, many soils are likely to be exhausted with respect to their potassium reserves and thus are becoming responsive to potassium fertilization (Malik *et al.*, 1987).

In Pakistan, soils are designated as low, medium or high on the basis of $NH_4$0Ac test but without correlating the test values with crop response. The soil testing laboratories need simple, rapid, and cheap but reasonably accurate methods for potassium analysis. We present data regarding the correlation between the amount of K extracted with different extractants and K uptake by wheat cv. LU26S.

MATERIALS AND METHODS

The soil samptes were collected from 0-15 cm and 15-45 cm depths of the three soil series viz., Shahdara, Nabipur and Lyallpur (Table 1). These were air dried, ground, passed through a 2mm sieve and added to plastic pots (3.5 kg capacity) at the ra te of 3 kg per pot. The fertilizer combinations were N_0P_0 (cont.roi), $N_{150}P_{44}$ and $N_{200}P_{66}$. Nit:ogen as urea a~d phosphorus as slngle superptiosphate were applied before sowmg the crop. Six grains of wheat variety LU26S were sown in each pot and on germination thinned to three plants per pot. Canal water was used for irrigation. The crop was harvested at maturity. Grain and straw yields were recorded (data not given). potassium concentration in both the parts of the plant was determined (U.S. Salinity Laboratory Staff, 1954). Potassium uptake by wheat from each pot was calculated by using the formulae:

$$\text{K uptake by grain (mg pot}^{-1}) = \frac{\text{\% K in grain} \times \text{Grain yield (g)}}{100} \times 1000$$

$$\text{K uptake by straw (mg pot}^{-1}) = \frac{\text{\%K in straw} \times \text{Straw yield (g)}}{100} \times 1000$$

$$\text{K uptake by wheat (mg pot}^{-1}) = \text{K uptake by grain} + \text{K uptake by straw}$$

To characterize the soils used, evaluation of total nitrogen and available phosphorus was done by Jackson (1962) and Watanabe and Olsen (1965), respectively. Extraction of potassium was done by H_2O, IN NH_4OAc, 0.5N MgOAc, 0.025N $CaCl_2$ and IN HNO_3.

Table 1. The physical and chemical properties of the soils used in the study

Soil series	Depth (cm)	Texture	pH	EC (dS m-1)	[illegible]	Available [illegible]	Available [illegible]
[illegible]	0-15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	15-30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0-15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	15-30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0-15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	15-30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RESULTS AND DISCUSSION

Potassium uptake by wheat

Potassium uptake by wheat increased with the application of nitrogen and phosphorus to all the soil series (Table 2). This indicated that ample available potassium was present for improving the N and P fertilizer use efficiency. Potassium uptake by the crop was more from surface *soil* (0-15 cm) than from subsurface soil (15-45 cm) except for the Shahdara *soil* series (in the control) and the Nabipur soil series *in* all the treatments. It may be due to the fact that soil samples of the Nabipur soil series were taken from the paddy area where most of the potass*ium* might have leached from surface to subsurface soil.

Potassium extracted by various extractants

The water extractable potassium from all the soils was lower compared to that with the other extractants (Table 3). The extractants 1N NH_4OAc, 0.5N MgOAc and, 0.025N $CaCl_2$ extracted greater amount of potassium, partially exchangable fraction also. The higher potassium extracted by 1N NH_4OAc than that with 0.5N MgOAc and 0.025N $CaCl_2$ might be due to the size of NH_4^+ being similar to that of potassium. Even NH_4^+ can extract potassium from interlayer *sites* of 2:1 clay minerals while calcium and magnesium cannot because of larger ionic *size.* Potassium extracted by 1N HNO_3 from all the soil series was higher than all the other extractants. The acid might have extracted non-exchangeable potassium *in addition* to available fraction.

Correlation between potassium uptake by wheat and potassium extracted by various extractants

Potassium extracted by all the extractants was positively correlated *with* potassium uptake by wheat in all the treatments. 1N NH_4OAc-K was highly correlated ($r = 0.984$) with potassium uptake by wheat plants in the control, 0.025N $CaCl_2$ proved best extractant in T7 ($N_{150}P_{44}$) and T3 ($N_{200}P_{66}$) *giving* values of $r = 0.936$ and $r = 0.81$, respectively. Similar values calculated for H_2O and 1N HNO_3 were nonsignificant for all the treatments except in the control for 1N HNO_3. This leads to the conclusion that all the extractants other than H_2O and 1N HNO_3 can provide good index of soil available potassium for optimum growth of wheat.

Table 2. [illegible]

Soil series	Depth (cm)	Treatments		
		Control	N 150 [illegible]	N 200 [illegible]
[illegible]	0-15	[illegible]	[illegible]	[illegible]
[illegible]	15-45	[illegible]	[illegible]	[illegible]
[illegible]	0-15	[illegible]	[illegible]	[illegible]
[illegible]	15-45	[illegible]	[illegible]	[illegible]
[illegible]	0-15	[illegible]	[illegible]	[illegible]
[illegible]	15-45	[illegible]	[illegible]	[illegible]

Table [illegible]. [illegible] (mg kg[-1])

Soil series	Depth (cm)	Extractants				
		H_2O	1N NH_4OAc	[illegible]	[illegible]	1N HNO_3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Na[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Na[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Correlation between extractable [illegible] and [illegible] uptake by wheat

[illegible]

[illegible]

[illegible]

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