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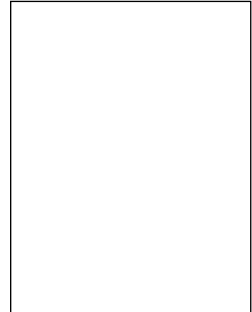
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## Kinetics of Soil Potassium Release under Long-term Imbalanced Fertilization in Calcareous Soils

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### ABSTRACT

The kinetics of potassium ( $K^+$ ) release under continuous fertilization with urea and triple superphosphate without  $K^+$  was investigated in chloritic and kaolinitic soils. The kinetics of  $K^+$  release from the soils in the N and P treatments was also studied in order to compare the obtained results. The results showed that the kinetics of  $K^+$  release included an initial reaction and a slow reaction. The phosphate- and ammonium-induced  $K^+$  release followed the same rate process during initial (2 – 192 h) and (192-1090 h) reaction periods. There were no significant differences between cumulative  $K^+$  released amount from chloritic and kaolinitic soils among all treatments. The cumulative  $K^+$  released was correlated positively with P adsorption capacity for chloritic ( $r = 0.461$ ,  $P \geq 0.05$ ) and kaolinitic soils ( $r=0.625$ ,  $P < 0.01$ ) and negatively with fixation potential for chloritic ( $r = 0.720$ ,  $P < 0.01$ ) and kaolinitic soils ( $r= -0.513$ ,  $P < 0.01$ ). There was a significant ( $P < 0.001$ ) interactive effect of fixation potential  $\times$  P adsorption capacity on cumulative  $K^+$  released amount for both soil groups. Initial rate release (IRR), for chloritic soils were significantly ( $P < 0.05$ ) more under P and NP application. The IRR followed the order as: NP=P > N=C for chloritic and N=P > NP > C for kaolinitic soils. This study showed that the fixation of ammonium and P adsorption capacities control  $K^+$  release from soils. This information could be helpful for the precise fertilizer recommendation for the studied soils.

**Key Words:** fixation potential, initial release rate, mineralogy, P adsorption capacity, triple superphosphate, urea

### INTRODUCTION

Nutrient management is a key challenge for global food production amongst which the increase of nutrient availability for crop production in small farms is one of the most important priorities in developing countries (Powlson *et al.*, 2011). Although that calcareous soils of Iran have considerable native quantities of potassium ( $K^+$ ), with conventional cropping and without any  $K^+$  fertilization the cropping system would not be sustainable (Hundal and Pasricha, 1998).  $K^+$  as an essential element for plant growth can be divided into water-soluble, exchangeable, nonexchangeable and mineral phase (Martin and Sparks, 1985). Various there are dynamic equilibrium reactions between different forms of  $K^+$  are known to exist, while the nonexchangeable  $K^+$  can be an important reservoir of  $K^+$  in soils. Since plants use different proportions of nonexchangeable  $K^+$ , exchangeable  $K^+$  is not always a reliable method of bioavailable  $K^+$  determination (Jalali, 2006). Besides, availability of nonexchangeable  $K^+$  is not dependent on the quantity of interlayer  $K^+$ , but also on the release rate from the mineral phase in the soil. Hence, a comprehension of  $K^+$  release dynamics from all four  $K^+$  phases of is important to develop and recommend efficient and profitable  $K^+$  fertilizer application (Sparks and Carski, 1985). Numerous studies have been conducted on the kinetics of

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