Crop Res. 25 (1) : 66-68 (2003)
With one figure
Printed in India

Potassium content and its flux in rhizosphere region

R. SARASWATHY, G. ARUNACHALAM AND P. V. JEGADEESWARI

Department of Soil Science and Agricultural Chemistry
Tamil Nadu Agricultural University, Coimbatore-641 003 (Tamil Nadu), India

ABSTRACT

A pot culture experiment was conducted to study chemical properties of soils as influenced by root system of rice varieties in acid and alkali soils under two population levels and also nutrient uptake by rice varieties. Even though there was a decline in NH_4OAc-K content due to submergence, it went up in root-zone soil. Its content was more in alkali condition, but this trend was not reflected in potassium uptake of plant. The available potassium content was high in maximum tillering stage and was followed by post-harvest stage and flowering stage.

Key words : Acid and alkali soil, K content and K uptake, rice rhizosphere soil

INTRODUCTION

Rhizosphere region is the soil adhering to the root or soil volume well permeated by roots. The number of organisms in the rhizosphere region is greater than that of the unplanted soil. The root surface secreted significant quantities of organic compounds and the organic acids secreted by microorganisms can influence the transformation and availability of nutrients and also establishing eco-condition for the establishment of plants. Thus, the root-zone (Rhizosphere) soil differs physically, chemically and biologically from bulk soil (Carson, 1974). This paper deals with the available potassium content and its uptake under root-zone soil.

MATERIALS AND METHODS

Bulk samples of acid soil were collected from Rice Research Station, Ambasamudram and alkali soil was collected from the Agricultural College and Research Institute, Killikulam. These soils were classified as Typic Ustrochepts and Ty Rhodustalfs, respectively.

Five gram processed soil w transferred to specially designed tubular p of 30 cm height and 20 cm diameter. The was hand puddled and the water level w maintained at 5 cm level throughout experimental period. Twenty-three days seedlings of the rice varieties ASD 18 and 1444 were planted in pots at two populat levels equivalent to 66 hills m^{-2} (p_1) and hills m^{-2} (p_2). Ten pots were maintain (unplanted soil) without any plant under simi above said conditions. In other pots, gap filli was done after a week of transplanting ensure uniform population levels. Fertilizer applied at the rate of 100-50-50 NPK kg ha Half of the nitrogen, entire phosphorus an potassium were applied as basal. Th remaining 50% of the nitrogen was applied two splits : one at maximum tillering sta and the other at flowering stage. Adequate pla protection measures were given dependi upon the requirement. At the time of collecti the soil samples from pot, the flood wate the pots was drained, and the pots were tu

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RESULTS AND DISC

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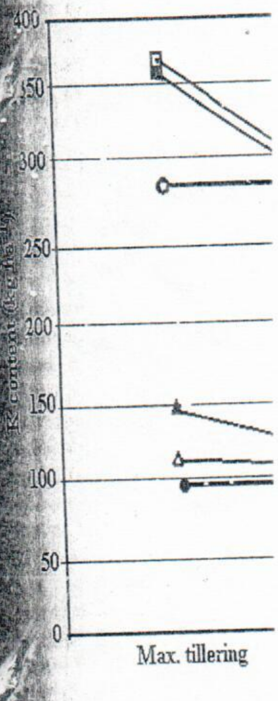

Fig. 1. Changes i

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ID P. V. JEGADEESWARI

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11 003 (Tamil Nadu), India

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The soil volume permeated by the root
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s collected and analysed for potassium
ntent by Neutral Normal Ammonium
etate method (Stanford and English, 1949).

RESULTS AND DISCUSSION

The available potassium was higher
der root-zone soil than in the unplanted soil.
nong the two soils, the alkali soil recorded
ximum available K in both the root-zone
d unplanted soil.

The available potassium increased with
pulation levels in the case of rice grown
der acid soils, whereas the reverse was true with alkali soils (Table 1). It indicates the enhanced potassium uptake including luxury consumption (Kuchenbuch, 1988). Kuchenbuch (1987) reported that when the potassium content was depleted there was an increase in the potassium flux towards the root

Table 1. Relationship between K content and K uptake

K content/ uptake	Root-zone soil			
	Acid soil		Alkali soil	
	p_1	p_2	p_1	p_2
Soil (kg/ha)	113.4	123.9	310.9	304.9
Plant (%)	1.82	1.76	1.59	1.66
Grain (%)	0.15	0.26	0.27	0.28

p_1 : 66 hills m^{-2}, p_2 : 115 hills m^{-2}.

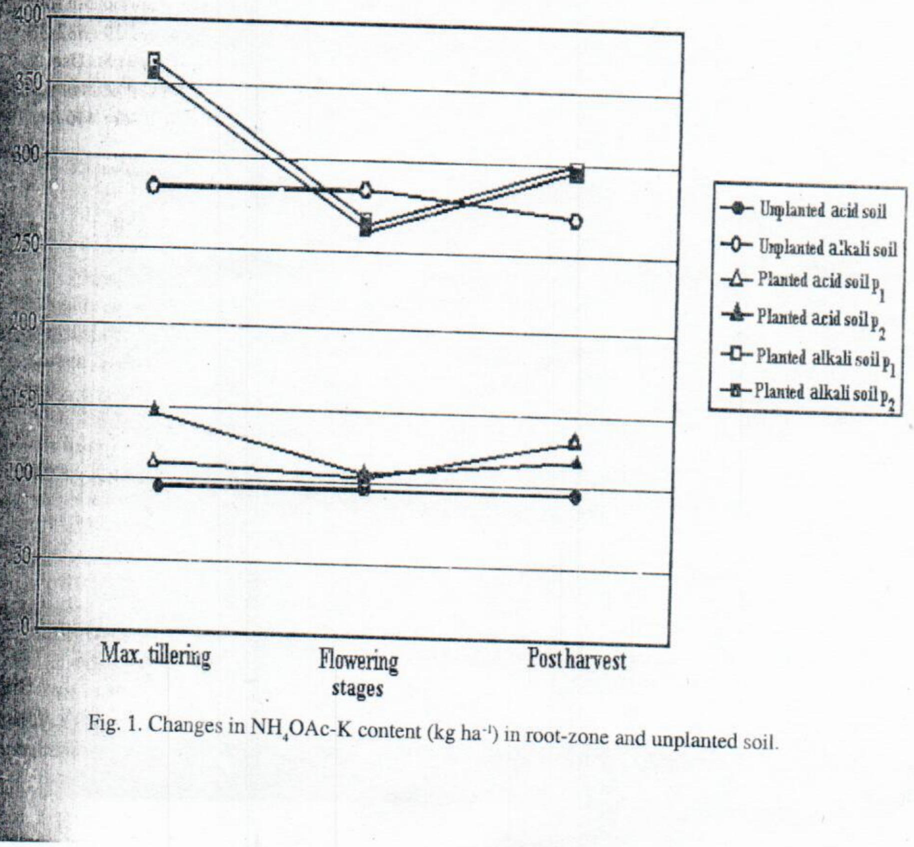

Fig. 1. Changes in NH_4OAc-K content (kg ha^{-1}) in root-zone and unplanted soil.

mainly through diffusion. The probable reasons that could be attributed for mobilization of potassium in the root-zone are intense microbial activity, organic acid secretion by root, dissolution effect of organic acids, etc. (Raghu and Mac Rae, 1966; Nagarajan *et al.*, 1970). The potassium content was high in maximum tillering stage and then declined after two weeks of submergence (IRRI, 1984). The root-zone effect was more marked in acid soils than the alkali soils (Fig. 1). However, in absolute terms available potassium was maximum in the root-zone of rice grown in alkali soils. But this trend was not reflected in potassium uptake by plant suggesting some other mechanism would exercise root-zone potassium content in plant. The soil chemical interaction like Ca : K ratio and Fe : K ratio might have been the deciding factor in potassium uptake. The alkali soils were used in the study, the exchangeable Ca : K ratio was 73, whereas in the case of acid soil, it was only 14.

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