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Short communication

STATUS OF POTASSIUM IN PEARL MILLET SOILS OF AGRA, UTTAR PRADESH

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Sound knowledge about soil fertility status is very much relevant for indentifying constraints in crop husbandry for attaining sustained productivity and facilitating agro-technology transfer programme. Potassium is one of the three essential primary nutrients for fostering crop production. Potassium functions in plant metabolism particularly in photosynthesis, respiration and enzyme activation. It plays an important role in the maintenance of the cellular membrane and keeping the protoplasm in a proper degree of hydration by stabilizing the emulsions of highly colloidal particles. Potassium deficiency influences metabolic processes, primarily related to photosynthesis and synthesis and translocation of enzymes. Potassium is involved in water relations, charge balance and osmotic pressure in the cells and across membranes (Havlin *et al.* 2014).Cultivation of pearl millet, an important kharif crop of Agra region, with very low rate or no application of potassium results in poor yield and causes depletion of potassium reserves in soil. Also these soils being coarse textured and low in organic matter, are more prone to leaching of soluble K beyond root zone.Not much work has been done in Agra district on the status of potassium in soil and pearl millet plants. Hence an attempt was made to assess the status of potassium in pearl millet soils in relation to soil and plants properties.

One hundred samples of soil (0-20 cm) and pearl millet plants from collected from various places of Agra district. The climate of the study area is semi-arid with an average rainfall of about 650 mm per annum, about 80% of which is received duringJune to Septembber. These soil samples were analyzed for EC, pH, organic carbon and free lime by standard procudes(Jackson 1973).Extraction of total potassium was done through percloric acid digestion of soil(Jackson 1973). Available K was extracted with 1N NH_4 O Ac (pH 7). Plant samples were digested with diacid (HNO_3 and $HClO_4$) mixture. The estimation of K in soil and plant extract / digest was done flame photometrically.

Table 1: Some physic-chemical properties and status of potassium in pearl millet soils and plants

Soil Characteristic	Range	Mean
pH (1:2.5)	7.5 - 8.9	8.3
EC (dSm^{-1})	0.10 - 0.50	0.24
Organic carbon (g kg^{-1})	1.5 - 6.0	3.7
$CaCO_3$ (g kg^{-1})	5.0 - 25.0	10.0
Total K (%)	1.05 - 2.25	1.66
Available K (kg ha^{-1})	60.0 - 200.0	117.6
Potassium in plants (%)	1.50 - 2.35	1.98

Pearl millet growing soils were alkaline in reaction , pH ranging from 7.5 to 8.9. The EC of the soil-water suspension (1:2.5) ranged between 0-10 and 0.50 dSm^{-1}. Organic carbon ranged from 1.5 to 6.0 g kg^{-1} with a mean value of 3.7 g kg^{-1}. The results showed that 80% soils were rated as low in the organic carbon content. The amount of free line in these soils ranged from 5.0 to 25.0 g kg^{-1} with a mean value of 10 g kg^{-1}. The total potassium content of the studied ranged from 1.05 to 2.25% with a mean value of 1.66 percent. These values were fairly comparable to the results reported by Chand and Swami (2000) for the soils of Bhartpur

(Rajasthan) and Singh *et al.* (2010) for the soil of Agra (Uttar Pradesh). These results suggested that the coarse textured soils would be depleted of soil potassium sooner than fine textured ones, therefore, continuous monitoring of soil potassium status is essential. Total potassium did not have any significant percent relationship with soil properties (Table 2).

Table 2: Relationship between soil properties and potassium in pearl millet soil

Soil Characteristic	Total K	Available K
pH	0.080	0.110
EC	0.131	0.368**
Organic carbon	0.179	0.401**
$CaCO_3$	0.012	0.051

*** Significant at 1% level*

The content of available K in pearl millet soils varied from 60.0 to 200.0 kg ha^{-1} with a mean value of 117.0 kg ha^{-1}. About 57 percent soils were rated as low in available K. Similar results were respected by Singh etal. (2010). Available K had significant relationship with total K ($r=0.71^{00}$). It had significant positive relationship with organic carbon and EC (Table 2). Similar results were reported by Kumar etal. (2009). Available K also had positive relationship with pH and C_aCO_3 but the values were non-significant. The content of potassium in pearl millet plants varied from 1.50 to 2.35% with a mean value of 1.98 percent. The extent of deficiency of K in pearl millet plants was of the order of 40 percent. Available K was found to have significant and positive relationship ($r = 0.75^{00}$) with plant potassium. It was evident from the results that availability of K to plants is largely dependent on the status of potassium in soils.

From the results, it may be concluded that pearl millet soils were low in organic carbon and available potassium. About 40% plants of pearl millet were found to contain low amounts of K in their leaves, Hence the soils require attention regarding management practices and regular monitoring of soil potassium for better crop production.

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