RELATIONSHIP BETWEEN
CATION EXCHANGE CAPACITY OF ROOTS AND
MINERAL COMPOSITION OF PLANT TOPS
AS INFLUENCED BY AGE

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SUMMARY

Maize (Hy-Ganga-101) and french bean (Waghya) were grown in pots using soil collected from Agricultural College Farm, Poona. Plant tops and roots were collected periodically. Plant tops were analysed for calcium, magnesium and potassium, and the cation-exchange capacity of the roots was determined. The object was to study the relationship between root CEC and mineral composition of plant tops as influenced by age. The results can be summarised as follows:

(i) Age of plant influenced root CEC of maize and french bean. In maize, root CEC increased up to the 30th day and gradually decreased till maturity, whereas root CEC of french bean increased up to flowering stage and decreased thereafter till maturity.

(ii) The cation content of the tops of maize and french bean did not show definite significant relationships with root CEC according to Donnan distribution of monovalent and divalent cations when the entire life period of the plants was considered. The probable reasons for this non-significant relationships are discussed.

The mineral composition of plant tops has been reported to be influenced by the cation exchange capacity (CEC) of the plant roots and can be explained on the basis of Donnan distribution. In 1962, Crooke and Knight evaluated the available literature on the mineral composition of the plants in the light of root CEC and reported considerable difficulty in explaining the relation of root CEC to differential cation concentration of the plants. However, the importance of Donnan distribution in relating cationic concentration of plant tops with root CEC cannot be overlooked.

The age of the plant is one of the important factors which affects the root CEC. It may be recalled that the mineral composition
of the plant also changes with age. The age factor, therefore, warrants consideration if the mineral composition of the plant tops is to be correlated with root CEC in the light of Donnan distribution theory. The object of the investigation was, therefore, to study the relationship between root CEC and mineral composition of plant tops as influenced by age of plant with reference to Donnan distribution.

EXPERIMENTAL

Two different species of crops namely maize (variety: Hy-Ganga-101) a monocot, and french bean (variety: Waghya) a dicot were grown in earthenware pots, each containing 5 kg of soil (< 2 mm), collected from Agricultural College Farm, Poona (pH 7.6; CaCO₃, 8.32%; clay, 40.01%; organic carbon, 0.5%; C.E.C. 65.31 me per 100 g). Before sowing the seeds, a basal dose of 50 kg N, 50 kg P₂O₅ and 30 kg K₂O per acre was added in the form of ammonium sulphate, superphosphate and potassium sulphate respectively. The soil in each pot was brought to approximate field capacity with the addition of deionized water and then the seeds were sown. Immediately after germination, thinning was done and 4 plants per pot were retained in a circular distance. The maize plants along with their roots were harvested at 3-day intervals upto 12th day and subsequently at 15-day intervals till maturity. The french-bean plants with roots were sampled according to their approximate physiological growth phases; namely, at initiation of flowering, flowering, pod formation, dough stage and maturity. The plant roots were then washed gently in tap water and subsequently in distilled water to remove adhering soil particles and were excised. After removing excess water by pressing the roots between blotting paper, they were cut into smaller pieces, oven dried at 80°C for 24 hours, weighed and finally milled to pass through 0.5-mm sieve. The root CEC was determined in triplicate by adopting method proposed by Crooke. After oven drying at 80°C the plant-tops were, analysed for mineral constituents like, Ca, Mg, K according to methods given by Piper and Chapman and Pratt.

RESULTS AND DISCUSSION

The data on changes in dry matter, root CEC and cation concentration of maize and french bean tops as influenced by age of plant are presented in Tables 1 and 2. The correlation coefficients for root CEC and contents of tops of maize and french bean are given in Table 3.