PART II

AMMONIUM FIXATION IN PUNJAB SOILS
INTRODUCTION

Fixation of ammonium in soils has not received as much attention as it deserves. In 1917, McBeth reported, that he was unable to recover more than 81 per cent of the ammonium salt added to California soil, even after prolonged extractions with ten per cent hydrochloric acid. Recent work has shown, that many soils have the ability to fix considerable amounts of ammonium and the ammonium fixing capacity increases with depth in the soil profile (Bower, 1950; Allison et al., 1953).

The mechanism of ammonium fixation in soils seems to be the same as that of potassium fixation, the indications being that ammonium ions replace inter-layer cations, such as calcium, magnesium, etc., in the expanding lattices of clay minerals and this causes contraction of the crystal lattices and entrapping of the inter-layer ammonium ions (Barshad, 1948, 1950, 1954). These entrapped ammonium ions cannot be easily replaced with other cations and are considered as fixed. The clay minerals chiefly responsible for ammonium and potassium fixation are illite, vermiculite and montmorillonite. The soils which fix potassium, can also fix ammonium. Stanford and Pierre (1947) found a positive high correlation between potassium and ammonium fixing capacity of Webster silty clay loam soils (of U.S.A.), under moist conditions.

It has been observed, that fixed ammonium in soils is not available to nitrifying bacteria and plants. Allison et al. (1953) reported that representative U.S.A. soils fixed 1.6 to 4.0 m.e. of ammonium per 100 grams of soil on air drying and 3.1 to 6.3 m.e. of ammonium per 100 grams of soil on heating to 100°C. The availability of fixed ammonium to nitrifying bacteria varied from 0 to 14.8 per cent. Millets grown in a green house assimilated 7 per cent of the non-exchangeable ammonium, that had been fixed by air-dried soils and 12 per cent of that fixed by heated soils.
 Nitrogen is the first limiting nutrient in the Punjab soils for crop production. Ammonium fertilizers are mainly used to meet the nitrogen deficiency. It has been observed, that an addition of ammonium fertilizers significantly increased the yield of crops in most soils. Our present knowledge of the utilization of ammonium fertilizers by crops and their behaviour in soils is quite inadequate. The Punjab soils are known to contain large amounts of illite and chlorite and small amounts of montmorillonite types of clay minerals (Kanwar, 1959 and 1961) which are known to fix ammonium. It is likely that ammonium fixation can be the cause of low availability of nitrogen and low yield of crops in this State.

Considering the lack of information about the availability and fixation of ammonium fertilizers in the Punjab soils and its practical importance, it has been considered timely to undertake the present investigations:

1. Nitrogen status of the Punjab soils;
2. Ammonium fixing in soils;
3. Availability of native and fertilizer fixed ammonium.