Molasses, Nitrogen Fixation and Land Reclamation

IN his presidential address to the United Provinces Academy of Sciences, India, on December 19, 1935, Prof. N. R. Dhar gave a general account of the work carried out by himself and his collaborators on nitrogen transformations in soil. Prof. Dhar leads the school of thought which believes that nitrification in soils and nitrogen fixation from the atmosphere are, especially in the tropics, photochemical at least as much as bacterial actions. Prof. Dhar has produced strong evidence in support of his theories, and the question appears now to have reached the stage at which the protagonists of bacterial and photochemical nitrification respectively are unwilling to admit any evidence which might shatter their beliefs.

Meanwhile, other soil workers will be wise to keep an open mind on the matter, for the philosophical implications of recognising that light plays a part in soils analogous to photosynthesis in the vegetable kingdom are at least as important as the practical possibilities of utilising that knowledge for the enrichment of the soil. Given sufficient facts, their practical application does not necessarily depend on their correct interpretation. The practical facts of Prof. Dhar's researches are that Indian soils are generally deficient in nitrogen, that more than half a million tons of molasses from the sugar industry are annually wasted in India, and that the application of molasses to the soil can double and may treble the soil nitrogen content, with a consequent large increase in crop yield.

Molasses contains about 70 per cent of carbohydrates and small quantities of nitrogen, phosphorus, potash, etc., these quantities, however, being much too small to account for the observed manurial effect. According to Prof. Dhar, the energy set free in the oxidation of the sugars in molasses is utilised, either bacterially or photochemically, in promoting nitrogen fixation and nitrification. Whatever the nature of the process, Dhar has produced indisputable evidence of increases in available soil nitrogen and crop yields following the application of molasses. Under temperate conditions, the converse result would be expected, as it is well known that the addition of carbohydrate-rich material to soil tends to reduce the amount of nitrogen available to plants, the nitrogen becoming fixed as microbial protoplasm or as humus. An essential difference, however, between temperate and tropical soil requirements is that, whereas in temperate regions the limiting factor to crop growth is often the slowness, in the tropics it is the rapidity with which soil nitrogen is made available to plants, soluble nitrates being formed and leached from the soil before they can be absorbed by the crop. The general effect of molasses on the soil should be the same everywhere, but only in the tropics will its 'braking' effect on the mobilisation of soil nitrogen be a positive advantage to the cultivator, and only in the tropics will its stimulation of atmospheric nitrogen fixation, whether bacterial or photochemical, be appreciable, since temperate regions lack the heat necessary for bacterial and the light for photochemical stimulation.

For these reasons, the potentialities of carbohydrate manuring—of which molasses manuring is an example—have perhaps been overlooked by agriculturists. If Prof. Dhar can substantiate his claims, he may effect a revolution in agriculture in India, where the supply of the ordinary organic manures is far below the demand. Prof. Dhar suggests that a most valuable use can be made of molasses in reclaiming alkaline land. The acids produced in the decomposition of molasses neutralise the alkalis, and at the same time and contrary to experience when land is reclaimed with gypsum or sulphur, soil nitrogen is increased. A period of about four years is usually necessary to reclaim alkali land with gypsum, whereas with molasses applied at a rate of 30–40 tons per acre, good crops can be grown within six months. It is not stated whether such reclamations have been found permanent—in view of the oxidisability of the neutralising acids, this is open to doubt but the method obviously merits further study. There are four million acres of infertile alkali land in India, and irrigation practices are increasing the area. The economic reclamation of these lands is one of the country's greatest agricultural problems, to the solution of which Prof. Dhar's work is pointing the way.

The Prehistoric Society

WITH the publication of its *Proceedings** for 1935, the Prehistoric Society, formerly known as the Prehistoric Society of East Anglia, completes the first year of its existence under the new style and organisation. The change will necessarily bring some broadening of outlook; but those who have followed with close attention the work of the Society under its old style, especially in recent years, are well aware that the change is one in form rather than substance. From the time of its first formation in 1908 the Prehistoric Society of East Anglia, though strong in its local membership, reaped the advantage of its geographical position. It had the strategic advantage that many of its local discoveries and local problems were of more than local interest; they were also of the first importance in the discussion of some of the most significant of the questions relating to the antiquity of man and prehistoric archæology at large. A glance through the later volumes of the *Proceedings* will show that the proportion of attention given to these larger questions and the tendency to view local evidence in the light of its bearing on the broader issues had steadily increased, until the Society, so

* Proceedings of the Prehistoric Society for 1935 (Proceedings of the Prehistoric Society of East Anglia, 1908–1935). Edited by Dr. Grahame Clark. Pp. 166+15 plates. (Cambridge: University Museum of Archæology and Ethnology.) £1.