The world population is approximately 6.5 billion (6.5 x 10 9) and it is expected to rise to 9.5 x 10 9 within the next few decades. This rise will greatly increase the likelihood of mass starvation on a scale not previously witnessed, unless there are increases in both the annual output of fertilisers and the efficiency of their use, especially with respect to nitrogen and phosphorus (N & P). World Agriculture has published two papers on the roles of N and P fertilisers. The difficulties confronted by each of these elements are quite different.

There is a limitless supply of N, as it is cycled from the atmosphere (78 %N2)to the soil and back. It is fixed in a reactive form by blue-green bacteria (Cyanobacteria), root nodule bacteria, lightning and as NH3 in the Haber- Bosch process for industrial and fertiliser use. The industrial fixation of N2 currently consumes 4 % of the world's supply of natural gas, as a source of hydrogen, and 1-2 % of total energy production, mostly as electricity, some of which is generated by natural gas (Smil 2011).

The situation with P is different. The world's available reserves of P are limit- ed and predictions of their life range from 50 years to centuries (Cornish, this issue). As world population increases, use of both N and P fertilis- ers will also increase. A

major improve- ment in the efficiency with which both N and P are used in agricultural rota- tions is essential. At present, this is measured as the amount in an edible crop expressed as a percentage of that in the fertiliser.

Experimental evidence from 15N studies indicates that, for wheat, the efficiency of N use can be very high:85-90 % (Smil 2011); but in agriculture as a whole it is of the order of only 30-35 % for both N and P, although a reliable estimate for P is at present questioned, owing to the difficulty of estimating the slow release of some of the residual P, which is fixed in soil. The value for organic fer- tilisers is no greater and their green- house gas production is worse (Goulding et al. 2011), although organic crop waste should, neverthe- less, be returned to the soil to main- tain levels of organic matter, whenever possible.

Meat consumption is increasing and this causes further stresses on the agri- cultural use of N. Not only is the yield of metabolisable energy (ME) pro- duced per ha lower in meat products compared with field crops but, in addition, N efficiency is much poorer as a consequence, in particular, of the high losses of N in excreta. This is reflected in a very low world-wide N efficiency of only 15 % for total food products (Ford, this issue, Smil 2011).

In order to improve the efficiency of use for both N and P by precision soil management, a detailed knowledge of top-soil status and climatic conditions is urgently needed on a field/area basis (Cornish, this issue), so that losses and pollution caused by their run-off can be reduced. For this purpose appropri- ate crop rotations and management are needed , as these also improve soil nutrient use.

An important factor in this may be the introduction of zero tillage, where soils and crops are suit- able (Cornish, this issue, Goulding et al. 2011); but have we not heard of this before? Faulkner (1945), wrote. “The truth is that no one has ever advanced a scientific reason for plow- ing. ----- it seems logical to suggest the wisdom of trying to devise imple- ments which negotiate the trashy sur- face!” Ah well, ‘is there nothing new under the sun?’ There is and a pur- pose of this Journal is to present reli- able evidence, to draw conclusions from it and to indicate possible consequences of alternative courses of action based on those conclusions.

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Comments

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