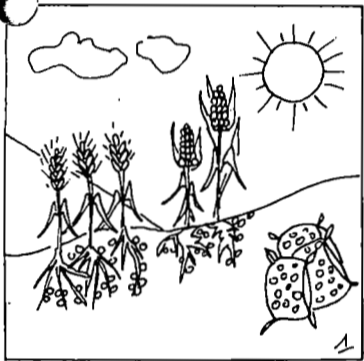


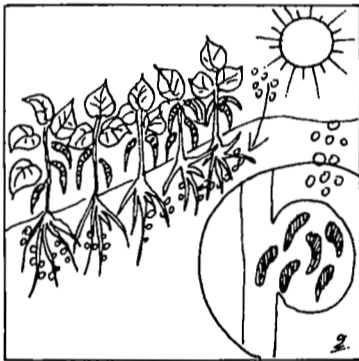
Words: 485 approx.

DRAWING NITRATE FERTILIZERS FROM THE AIR

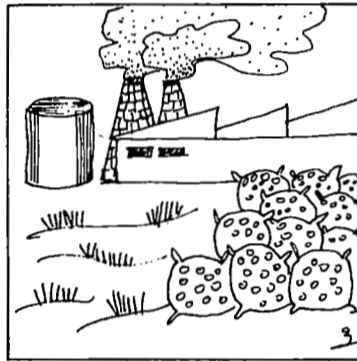
by ALEXANDER DOROZYNSKI



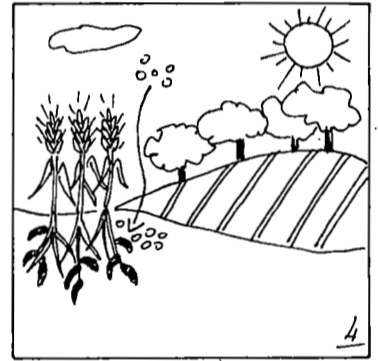
1. Most plants draw the nitrogen they need for their growth from the earth. If the soil is poor, or the cultivation intensive, fertilizers — particularly nitrate fertilizers — must be added.



2. Leguminous plants such as beans can, however, use atmospheric nitrogen. Bacteria penetrate into their roots where they form nodules: here they fix atmospheric nitrogen in a form usable by the plant.



3. As nitrate fertilizers, made from products such as petroleum, become increasingly expensive, attempts are being made to identify other nitrogen-fixing bacteria that could lead to considerable fertilizer savings.



4. While research in this field is still at an early stage, researchers have identified some bacteria that allow cereals to draw at least part of their nitrogen requirements from the air.

Nitrogen is an essential element for the growth of all plants.

Unfortunately, however, the nitrate fertilizers that have contributed to the extraordinary expansion of modern agriculture are becoming increasingly expensive. Made from fossil hydrocarbons such as petroleum they also constitute a non-renewable resource.

Yet nitrogen is abundant in nature, particularly in its free form in the atmosphere: close to 80 percent of the air we breathe is made up of nitrogen. Could this nitrogen be used to supply plant growth? This is what researchers in many countries are attempting to discover.

The problem is that neither plants or animals can directly use free nitrogen. It must first be converted into nitrates by micro-organisms in the soil. If this conversion occurs too slowly, the soil is poor and must be fertilized.

A kind of bacteria, the rhizobia, has long been known to be capable of fixing atmospheric nitrogen in a form usable by plants. Penetrating into the roots of legumes (beans, soybeans, alfalfa, clover), they form nodules. There they fix atmospheric nitrogen for use by the plant and in return receive nutritional elements, chiefly carbohydrates such as sugars.

Farmers throughout the world have long known that a soil depleted by successive cultivation of cereal crops can be enriched by planting legumes.

But can these nitrogen-fixing bacteria be used to supply nitrogen to cereal crops, man's main food source? Positive results have been obtained from trials carried out in a number of research centres, particularly in England and Brazil. Researchers have succeeded, in laboratories, to couple another nitrogen-fixing bacteria, the spirillum lipoferum, with cereals such as wheat, corn and even rice.

Under certain conditions this coupling can also be achieved in the field: its success depends partly on the soil type but mainly on the temperature, which must be fairly high. It is thought that agriculture in tropical areas will be able to draw at least a part of its nitrate fertilizers directly from the air, through bacteria.

Widescale utilization of nitrogen-fixing bacteria is not expected in the near future but research has, to date, yielded encouraging results. Dozens of nitrogen-fixing bacteria have been identified and, through modern genetic manipulation techniques, researchers are attempting to create new stocks adapted to particular crops.

The potential free use of atmospheric nitrogen would not just be a short-term solution to an economic problem; it could open up an entirely new area.

In the past, agriculture was a process of converting solar energy into food energy, man contributing his labor. Modern agriculture is entirely different: it is a process of converting fossil hydrocarbon supplies, once transformed into fertilizers, into food energy, through the sun's action and man's work. Such a situation cannot go on indefinitely, particularly as supplies are limited and intensive agriculture systems have oftentimes led to the amount of fossil energy calories used exceeding the food energy thus produced.

END