AMBASSADOR COLLEGE

BRICKET WOOD, ST. ALBANS
HERTFORDSHIRE, ENGLAND

Telegrams: AMBASCOL, ST. ALBAN *Telephone:* GARSTON 74074 *Telex:* 264114

NITROGEN FOR NOTHING!

The planet earth is right now teetering on the brink of world famine. Millions are suffering from a lack of protein in their diet. The world is not starving just for a lack of food, but rather from a lack of protein-rich food. Nothing will etch this into our minds more than pictures of African children suffering from kwashiorkor. Protein is lacking in crops and animals today. Why? Because the soils of the world are depleted, especially in their nitrogen content. Any fundamental book on nutrition will inform us that nitrogen is the key building block that plants must have to form the various amino acids that compose high-quality protein.

A World Shortage?

Modern science and technology has responded for the need of more nitrogen on our depleted soils. Their answer -- chemical nitrogen produced at high cost and sold to the food-producer! The world production of artificial nitrogen increased 12% last year to a total of 25 million tons. (The State of Food and Agriculture, 1969, FAO, Rome, p. 27.) Anhydrous ammonia, urea, diammonium phosphate, nitrates and many other forms of commercial nitrogen fertilizer are pouring out of high capacity factories. Nitrogen fertilizer factories are a favourite medium for passing foreign aid along to undeveloped countries. Prodigious efforts and enormous sums of money are expended to supply nitrogen to the world's depleted soil. But -- why should there be a shortage of nitrogen in the soil? In the atmosphere above every acre there are nearly 34,500 tons of nitrogen. (Soils, USDA Yearbook, 1957, p. 86.) The average crop only uses about 100 lbs. of soil nitrogen per year. Why then is nitrogen the most limiting element if the air has such a surfeit of it and crops need so little?

Availability -- That's the Problem!

The truth is that not a molecule of nitrogen in the air is available to higher plants in its gaseous form. The expensive, elaborate, complex, and odiferous nitrogen fertilizer factories convert gaseous nitrogen to a form available to plants. But man has been provided with a far more intelligently designed and less expensive factory to convert gaseous nitrogen -- the NITROGEN FIXING BACTERIA of the soil. Millions of these tiny nitrogen factories will do the work for the farmer if his soil is properly managed in accordance with the laws in nature!

How Effective Are Rhizobium Bacteria?

Compare these minaturized biological fertilizer factories with man's gigantic tubular-steel monstrosities, now being used to produce nitrogen to feed humanity's starving millions!

Many types of soil bacteria are capable of nitrogen-fixation. The most important, fix nitrogen in co-operation with legumes (clover, lucerne, peas, beans,

vetch, etc.). These are called, rhizobium bacteria. Under favourable conditions, rhizobia and legumes together, can produce up to 300 lbs. of nitrogen per acre in a single year. (Fundamentals of Modern Agriculture, F.J. Blake, p.359.) That is four to five times the nitrogen needed for a 40 bushel crop of wheat.

Rhizobia occur in the soil as minute round dots and rods. They are one of the smallest organisms in existence (10 million to the cc.). (Ibid, p.359) The association with the legume plant begins early, just after the first true leaves have formed and opened. From its roots, the plant excretes a substance (unknown to date) that stimulates the rhizobia organisms to swim to the root hair and multiply there. Their maximum speed of travel is only one inch in 24 hours. A colony of rhizobia forms near the tip of the root hair. The bacteria colony excretes another substance. This chemical (also not clearly known) causes the root hair to become deformed and curl in shepherd's crook fashion. The bacteria nestle themselves inside the shelter of the root itself. The nodule forms on the root hair at the point of bacterial penetration. Small "pipelines" form between the nodule and the centre of the root. Through the pipelines flow the food and energy substances from the plant root to the bacteria multiplying rapidly in the nodule. (Ibid, p. 361.) So in each nodule there are far more working bacteria than there are people in Britain. Amazing, isn't it -- billions of voluntary workers that only go on strike when the natural laws that govern our environment are broken. By living in symbiotic relationship with a leguminous plant, these bacteria are able to convert gaseous nitrogen from the air to a form that plant roots can absorb and assimilate. (Summary from The World of the Soil, Sir E. J. Russell, Fontana, 1957, pp. 88,89.) The process is mutually beneficial though both plant and bacteria can exist very well without each other. (Ecology of Soil Bacteria, Liverpool University Press, 1967, p. 400.) It is a perfect symbiosis.

Rhizobia Baffle Scientists!

Rhizobia are even more wondrous when we understand that modern science does not know how bacteria fix nitrogen. It is an unknown process. Note what one scientist said recently:

"A technical hope of considerable interest, which is exercising research workers in several countries, is that we shall discover precisely how the nitrogen-fixing bacteria do the trick. The synthesis of ammonia in chemical plants is at present carried out at high temperatures and high pressure, yet insignificant-seeming bacteria can accomplish nitrogen fixation on a cold English day from unpressurized English air." (The Environment Game, Nigel Calder, Secker & Warburg, London, 1967, p. 57.)

Sounds fantastic? It is! Yet there are billions of rhizobia attached to every clover, lucerne, pea and bean plant grown in healthy soil.

The Importance of Rhizobia Bacteria

How important are rhizobia to mankind? Let Sir E. John Russell, (former Director of Rothamsted) give the answer:

"ALL HUMAN, ANIMAL AND PLANT LIFE IS COMPLETELY DEPENDENT ON NITROGEN FIXATION, and it is a sombre thought that the ability to effect this is

possessed by so few and such lowly types of organisms." (The World of the Soil, Sir E. F. Russell, Collins, London, 1957, p. 92.)

Another noted agriculture writer has this comment:

"I restrict myself to pointing out the very great importance of encouraging the biological fixation of nitrogen. That is our only substantial hope from the land. In spite of all technical advances, it remains true that bacterial fixation of nitrogen by legume-nodule bacteria in partnership with leguminous herbaceous plants is THE CHIEF SOURCE OF PROTEIN FROM LAND FOR MAN AND ANIMALS." (Microbes and Man, Hugh Nicol, Penguin Books Ltd., London, 1955, p. 67).

So now we see the only sensible and practical way to solve the world's increasing need for protein. It is estimated that rhizobia bacteria produce over 100 million tons of nitrogen per year as opposed to only 25 million tons produced by chemical fertilizer factories during the year of 1967-1968.

No Equal in Economic Efficiency!

In addition the rhizobium factories have other advantages to make them the best fertilizer factory ever designed. Their nitrogen is produced right where it is required -- on the root itself. Not so with nitrogen produced commercially. Once commercial nitrogen is produced, it must be transported to the farming area. In the United States big pipelines are being laid at great cost simply to carry anhydrous ammonia (a form of nitrogen) 1,000 miles from Texas to the Midwest. Then the fertilizer must be distributed to individual farmers -- requiring more expense in trucks, wagons, tanks and buildings. After that the farmer must purchase costly application equipment to tow behind his tractor -- to place the nitrogen beside the roots -- right where the rhizobium factories would have been all along! Doesn't it sound ridiculous to go to all this effort?

The living dynamic action of the soil is so designed that it does not need the prodigious efforts of science, technology and industry to produce high quality plants.

Yet man today in his lust for money and in the glitter of high-pressure advertizing, overlooks the far greater benefits that could be reaped by working in harmony with God's laws. Remember, too, it can be easily shown that application of commercial nitrogen to soil prevents the rhizobia factories from doing their job.

The implications of ignoring the free and natural system for fixing nitrogen in the soil are far-reaching -- to say the least. Once they are set before us they make the giant pollution-producing chemical fertilizer industry look like an economic Frankenstein monster. On the other hand they make the symbiotic relationship between rhizobia bacteria and leguminous plants appear like the fantastic miracle of Creation which it really is!!

AGRICULTURE DEPARTMENT

ANN

SOURCES OF INFORMATION

The following books along with our own material will help you become familiar with the principles of natural farming:

The Soil and Health by Sir Albert Howard describes organic agricultural experiments on several continents in the first half of this century. He presents thoroughly documented information and was knighted by the British Monarch for his agricultural research. The book is published by the Devin-Adair Company, 23 East 26th Street, New York. Another excellent book by the same author is An Agricultural Testament, published by the Oxford University Press.

The Living Soil by Lady Eve Balfour describes the experiments of many top agricultural scientists, showing the relationship between the organisms of the soil and health of crops and man. It is published by Devin-Adair.

A very comprehensive 900-page book on raising fruits and vegetables is: How to Grow Vegetables and Fruits by the Organic Method, published by the Rodale Press, Chestnut Close, Potten End, Berkhamsted, Herts. This is the best book we have seen on the subject. The Complete Book of Composting with over 1,000 pages of information on methods of making compost successfully, is also available from the same publisher.

A book which shows the fertility chain in soil, a blue-print for soil management and the dynamic natural laws which rule the land giving man his food, is Farming With Nature by Joseph A. Cocannouer published by the University of Oklahoma Press, Norman, Oklahoma.

Books describing actual experiences with large acreage, tillage and fertilization practices of two famous English natural farmers are: Modern Humus Farming by Friend Sykes and Fertility Farming by Newman Turner. Both are published by Faber and Faber Limited, 24 Russell Square, London, W.C. 1.

Make Friends With Your Land is a book by Leonard Wickenden, a professional chemist who approaches soil, animal, and human health from a chemist's viewpoint. Mr. Wickenden, in a very readable, easily understood style covers many aspects of soil health, including a very good chapter on composting.

A book on tillage practices, but now out of print and available only in some used-book stores, is, Plowman's Folly by Edward H. Faulkner. Good public libraries should have at least some of these books. Anyone who is in the business of farming and who can afford the reasonable cost will find them well worth buying.

Animal Husbandry Heresies by Allan Fraser, published by Crosby Lockwood and Sons, London. The author is a man of considerable background and he effectively shows "Science" is no "Agricultural Messiah".

Practical Organic Gardening by Ben Easey, published by Faber and Faber, London. The title of this book adequately describes its contents. The author gives much useful and detailed information on composting and the use of green manure.

Better Grassland Sward by Andre Voisin, published by Crosby Lockwood and Sons, London. This book provides some very interesting points of Ecology, Botany

and Pasture Management by a Frenchman. The author shows a lot of understanding about the key part livestock play in agriculture. He also has some sound ideas on ploughing and short-term leys.

Gardening Without Poisons by Beatrice T. Hunter, published by Hamilton's, London. A most valuable book for anyone who sincerely desires to garden without the "benefits" of the modern chemical industry.

The Earth's Face by E. Pfeiffer, published by Faber and Faber, does more to give the full ecological picture than any other book we have read.

The "Journal of The Soil Association" is a quarterly magazine published by the Soil Association, Walnut Tree Manor, Haughley, Stowmarket, Suffolk, England. This is the best technical journal on natural farming we know of and is available for £3 per year.

The Organic Way to Plant Protection by Rodale is a "mine" of information on this aspect of natural farming and gardening.

The Grass Crop by William Davies, published by E. & F.N. Spon Ltd., London. A very comprehensive book on the principles of grassland management and establishment by an author of wide experience in both Britain and The Commonwealth.

Grasses & Grassland Farming by Hi Staten, published by Devin-Adair Company, New York. A very down-to-earth approach to the problems and potential of pastures in The United States.

Prophet of The New Age is a biography by Robert Waller of Sir George Stapleton (the "father" of modern grassland improvement). This book is published by Faber & Faber, London and gives many interesting concepts on the place of agriculture in the community.

Supplies of most of the above books should be available in Australia, New Zealand, and other English-speaking countries from leading Libraries, Booksellers, and Second-hand Bookstores in the Capital cities.

AGRICULTURE DEPARTMENT