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TWO BETTER BLADES OF GRASS

WE have become so accustomed to thinking of increasing our food production as merely a matter of opening up new land that it is somewhat shocking to realize that the world supply of new land is just about exhausted. We must think, in these days, how to make two blades of grass grow on land where only one grew before. Or, if we insist upon extending our farm land we must make it out of worn-out or inferior soil, after learning how to correct its shortcomings.

Soil, plants, animals and men are dependent upon one another. If the human race is to survive, we must concern ourselves with seeing to it that the soil is preserved and conserved. It must be protected from washing away or blowing away, and it must be enriched so that it has the proper nutrient qualities for our plants.

There is no use in our eating apples to keep doctors away, or carrots to improve our eyesight (even if these results are guaranteed) unless the apples and the carrots have secured from the soil and incorporated within themselves the natural excellence they should have.

Attention has been directed by national and international organizations to the plight of people in foreign lands who have not enough food to go around. It is time we in Canada turned our attention to this other aspect of the food problem. We need to think of quality as well as quantity. One good turnip may provide as much nutrition as two poor ones, and if we can grow the same number of good turnips as poor ones we have thereby doubled our crop of food.

The lack of a plant nutrient in soil may be made up by applying manure, adding commercial fertilizer, and using farm management. Because the deficiency may communicate itself to every one of us through our daily meals, these three features of farming become of pressing importance to people in every business and in every part of Canada.

A run-down soil grows run-down food. Every crop takes away part of every mineral from the soil, and every bank customer knows only too well the budget

difficulty he gets into when he withdraws continually without putting equal amounts or more into his account.

In the Farmers' Hands

Our health is to a large extent in the hands of our farmers. The veterinarian may put drug store remedies into the feed box to cure the ailments of livestock, and physicians may prescribe pills and tonics to cure the ills of mankind brought about by eating faulty food, but the farmer can contribute year by year to the prevention of physical disorders in men and animals by producing crops that are abundantly supplied with the necessary and proper qualities.

Our soil must be made so productive that it supplies the required elements in proper balance for the normal growth of the plants we need for health.

We can't judge food by our taste. Generations of faulty feeding have robbed us of the taste-test used by animals. Professor J. H. Ellis, of the Soils Department of the University of Manitoba, said in an address published by the Manitoba Department of Agriculture that animals have an instinct or they develop some sense of values in regard to the healthfulness of feeds. If allowed to range at will, they avoid the less nutritious areas and gravitate with unerring accuracy to the high mineral feeds on the better soils. When given free choice under a kind of cafeteria system, animals will first consume the food that is most needed for body functions.

This brings us to the question of bulk versus quality. Is our food supply to be called "good" just because there is plenty? By no means. It is good to have high yields, but luxuriance of crops of itself is not goodness. Goodness in food plants should imply possession of those qualities that satisfy the requirements of animals and men for heat, for energy, for growth, for body repair and for reproduction. To achieve such goodness is a noble ambition for our farmers, and to retain it is an equally high aim for our food processors.

What Plants Need

It may be worth while to consider briefly what is needed from the soil by plants, livestock and human

beings. All are part and parcel of the same nutrition cycle which governs all living cells.

Plants are living things. They take in food and convert it into body tissues and energy. They seize the energy of the sun's rays to build their tissues out of inert material.

Set a child and a cow on a heap of minerals, surrounded by air, and with a tub of water: all the chemical elements required for their bodies would be present. They would die of starvation, because neither of them has the power to combine the chemical elements into the food they require. But plant alfalfa and grass and micro-organisms in the soil minerals, water them, and give them air: the alfalfa and grass will grow, converting the chemical elements into plant tissues containing the food compounds needed by the cow, and the cow in turn will convert the alfalfa and grass into milk, which will provide food for the child.

This is a highly simplified illustration of food supply. The amount of nourishment gathered into a crop depends upon three factors: the amount of crop root in contact with the soil, what goes on where they touch each other, and the time they are in contact. In all this there is activity by the plant and by the soil. The result is influenced by sunlight and other factors as well as by the quality of the material of which the soil is composed, but what the plant has of food value depends in all but a tiny measure upon the fertility of the soil.

Livestock Requirements

Livestock farming has been found to provide the least drain on soil richness, because less plant food is exported in animal products than when crops are sold off the farm, and a greater portion of the fertility is retained in the form of manures. However, livestock raise other problems.

Regular and adequate supplies of certain minerals in the diet of animals are necessary if they are to grow and produce and remain healthy. Some, such as calcium and phosphorus, are required in considerable amounts to provide for proper bone development. Others, such as copper and cobalt, are equally necessary, though in much smaller quantities.

Common sense tells us that dairy or meat products from run-down pastures, lacking in these minerals, cannot possibly have the nourishing values of similar products from well-bred and healthy animals reared on balanced, nutritious forage and pastures.

Sir Robert McCarrison showed by experiment in India that health and disease are the result of the quality of the food eaten. He produced at will almost any disease he desired, simply by varying the diet of the rats with which he was experimenting.

There are two interesting ways of judging the quality of crops grown for animal feed. A deficiency in soil nutriment may affect the plant by limiting its growth, or it may be a deficiency in some mineral which is not needed by the plant but should be passed on by it to the animal.

Pasture for livestock belongs on good soil, not any old good-for-nothing-else corner of the farm. It should be seeded to productive grasses and legumes, fertilized to maintain high yields, and managed so that the herbage is grazed uniformly. The good pasture should have several types in its makeup — permanent, rotational and temporary — thus providing plentiful grazing all season.

Owners of livestock do not like to be told that they are starving their animals, but that is just what is happening when over-grazed, under-fertilized land is seen under the hooves of runty, scrubby and anaemic cattle. The under-nourished grass does not fatten; it may be a filler, but it is not food.

Experiments at Ottawa conducted continuously since 1930 have proved that pasture production can be increased economically by the use of fertilizer. It encourages the growth of clovers and the desirable kinds of grass, and increases the percentage of protein and minerals in the fodder.

Human Health

The quality of the food we eat is the chief factor in our physical fitness. No health campaign can succeed unless the materials of which the body is built are sound.

Professor Ellis said, in the address previously referred to: "To be healthy is to be well fed. If the foods produced by farm and garden satisfy all food requirements so that bodies can be kept in health, then the works of our hands are good. On the other hand . . . if the women develop goitre, if the babies have rickets, if the men cannot work because they are crippled with arthritis, if the children have white spots on their teeth, or if the girls have anaemia . . . these disorders are evidences of malnutrition and faulty feeding."

Many of the soils on which food crops are grown do not supply the plants with sufficient minerals to enable them to synthesize vitamins in quantities to meet our demands. Further, and worse, we are not satisfied to use many of our plant products in the form in which nature gives them to us, but demand that they be processed. Unless we know what nutrients are removed in the processing, and make up the quantity from other sources, we do not get enough of them.

Every step in food production is important. We have the right to ask that the nutrition value of our food shall be safeguarded all the way, through cultivation of the fields, harvesting, processing, distribution, preparation and serving.

Managing the Land

To produce food of the highest quality to feed today's world population is far from the subsistence husbandry of other days. The ownership of land is a privilege, but it is also a responsibility.

Soil fertility can result only from the foresight, labour and study of generation after generation. That sort of farming can make soils naturally poor into farms agriculturally rich, and soils naturally fertile into lasting yielders of still more nutritious crops.

What we are talking about now goes far beyond ordinary soil conservation practices such as irrigation, contour ploughing, planting cover crops to prevent wind erosion, and all that. Many farmers who have taken all the conservation measures written about in text books have been disappointed. They have seen their crops dwindle in quantity and quality, but didn't know just what to do about remedying the situation. The secret is to regulate the quantity and the quality of organic matter and plant food available to the growing crop.

This starts, perhaps, with cultivation. In the United States, the area in clean cultivation and row crops approaches one-half of the cultivated land; in France and England, with their longer agricultural experience, only about one-fourth of the cultivated soils are in clean cultivation. Sod crops have been found to be a most important factor in holding the soil and maintaining its healthy productivity by their regular additions of organic matter.

The question is, of course, how far should a farmer go in ploughing, discing, hoeing, and the spreading of manure and fertilizer? Canadian agriculture consists of many agricultures, with regions differing widely in their soil condition and requirements. What is successful on one farm may be ruinous on another.

No farmer need remain in ignorance of the needs of his land. The necessary instructions and question blanks for soil surveys are available from agricultural representatives and agricultural colleges, and samples of soil will be tested and reported upon, and recommendations will be made for tillage and improvement.

Soil surveys are not an end in themselves. They are like the physician's diagnosis that tells what is wrong and leads to the proper treatment.

Just how intricate is the matter of soil selection and soil feeding may be shown by a few examples. Consider cobalt. There is no evidence that cobalt is necessary to the plant's health, but soils deficient in cobalt may produce crops so low in cobalt content that animals cannot get enough for their requirements, even though they have ample bulk of feed to meet all other needs.

Soil deficiencies in other minerals stunt the growth of the plants themselves, reducing the quantity of feed. Too much potassium may bring about a shortage of magnesium. When there is lack of nitrogen, the plants cannot use phosphorus or potash effectively, even though they may be present in the soil in adequate amounts. And, still more complex, if we follow an all-too-common practice of returning to the soil only nitrogen, phosphorus, potassium, sulphur and calcium, we are hastening the depletion of the other plant nutrients through increased crop production.

Maintaining Fertility

Fertilizer, properly chosen and applied, is an indispensable friend of the farmer. We shall need fertilizer always, because every crop harvested or grazed removes nutrient elements from the soil. We must deposit if we are to continue to withdraw.

Fertility can only be maintained in one of two ways: either by supplying large quantities of organic raw materials from which humus can be manufactured in the soil itself, or else by manufacturing humus outside the soil and applying it to the land as a finished product.

To a person not a farmer the sensible approach to a solution of this question would go something like this: the soil is my capital; it is not inexhaustible; every crop I harvest, every beast I graze, removes some of my capital; that capital must be maintained. The best way to maintain it is like this: I will get information from my agricultural representative or the nearest agricultural college about the mineral requirements of all the kinds of crops I might wish to grow; I will have my soil tested to find out what it contains and what it lacks; then I will sit down and make a budget. Knowing how many pounds of each mineral will be removed by the crop I intend to have, I shall know the composition of fertilizer and the amount of fertilizer I should apply to meet that year's needs and provide a little "kitty" for other years.

Natural or Artificial?

There has been controversy from time to time about the relative value of organic fertilizers of animal origin as opposed to chemical fertilizers produced commercially. Traditional ideas tend to linger, but usually join themselves to newer ideas in a compromise agreement. That is so with reference to manure versus artificial fertilizers.

It is true that continuous injudicious use of artificial fertilizers may lead sometimes to a loss of soil structure, but on the other hand manure and other natural fertilizers cannot be said to provide everything needed for all sorts of land in the proper balance. Artificial fertilizer is usually applied for the current crop, and the carry-over of benefit to future years is less than that provided by farmyard manure. Some soils respond to manure, and others respond to artificial fertilizer.

This problem is better solved after talking it over with people at a Dominion Experimental Station, a Provincial Department of Agriculture, an agricultural college, or with your agricultural representative.

Organic Quality

Holding a major place in our economy (though seldom thought of by any but agricultural scientists) is the organic quality of our soil. It is an important natural resource, a major factor affecting the levels and quality of crops this year and in the future, and a vital feature in the productive life of every farmer.

Organic matter, sometimes loosely called "humus", is composed of plant and animal matter undergoing decay. It includes such material as dead roots, leaves, fruits, and stems of plants; carcasses of insects, worms and animals; live and dead soil micro-organisms; and various products of decomposition of dead tissues. It tends to bind loose soils, open up heavy soils, and increase the water-holding capacity of all soils. In decomposing, it liberates nutrients which are then available to the plant.

The most common methods of maintaining the necessary organic matter in the soil are by the use of farm manure, cover crops and residues. Our neglected wastes of straw, corn stalks, and so on should be put to active work. No one should minimize the importance of organic matter in the soil. It is one of the essential or major factors in successful crop production.

In addition to turning under the residues of crops after harvest, we may grow plants with the sole purpose of turning them under. The function of a green-manure crop is to add organic matter to the soil; the purpose of a cover crop is to prevent erosion, to shade the ground, or to protect the ground from excessive freezing and heaving.

In reckoning the value in dollars and cents of either practice, the farmer should keep in mind the investment feature. The increase in the following crop may or may not be great enough to pay for the ploughed-under crop or the year of sod, but these practices may have a marked effect on yields of subsequent crops for two or more years. A man's objective should be to so plan his land use that the organic matter will be maintained so far as is consistent with a reasonable use of the soil.

Commercial Fertilizers

Artificial fertilizers must be regarded as an essential requirement of agriculture. They supplement the production of plant food by the soil body itself, they improve the quality of the vegetation, and they help to preserve the soil.

Farmers are accustomed to look at fertilizers in terms of cost and yield. The fertilizer which is cheapest in dollars per ton may not necessarily be the cheapest in actual content of plant food or in actual fertilizing value. The price should bear some relation to the nutrient qualities of the contents and their fitness for the soil where use is planned.

Sales of mixed fertilizers and of fertilizer materials for direct application to the soil by Canadian users amounted to 764,581 tons in the year ended June 30, 1950. It is interesting to see the provincial distribution of these sales (amounts are in short tons): Newfoundland 4,214; Prince Edward Island 47,279; Nova Scotia 32,744; New Brunswick 71,459; Quebec 148,036; Ontario 346,568; Manitoba 21,560; Saskatchewan 31,015; Alberta 32,876; British Columbia 28,830.

The sale of all fertilizer materials is regulated by the Plant Products Division of the Dominion Department of Agriculture, under authority of the Fertilizers Act.

The practice of mixing artificial fertilizers has become common. The elements nitrogen, phosphorus and potassium are of great importance to plant growth, and commercial fertilizers may carry one, two or all three, together with other elements.

Mixed fertilizers are described by a series of three numerals, such as 5-10-5, which means 5 units of nitrogen, 10 of phosphate, and 5 of potash, always

stated in that order. The Fertilizers Act requires that substances or elements in addition to these three shall be marked on the package. If one of the elements is boron, there must be a warning given that the fertilizer should be used only when recommended by a competent authority.

Applying fertilizer in the right place is fully as important as applying the right analysis or the right amount. Progressive manufacturers of farm equipment have improved their distributors in accord with the findings of scientists in laboratories and field men making on-the-land tests.

There is no general pattern, but it has been found more efficient to place the fertilizer at the sides of the seed or plant, where it will be available when it is most needed. This can be done by using a proper fertilizer attachment on the seed drill, thus combining two operations in one.

It is good practice for the farmer to leave a check strip in his field. This unfertilized strip will enable him to observe the effects on growth throughout the season, and to estimate the advantages obtained from the use of fertilizer.

A Way of Life

This has not been by any means the whole story of our food needs and the usefulness of good husbandry in meeting our needs. To tell that would mean going back far into antiquity, and looking past the atom bomb into the future. Our horizons are widening insofar as technical knowledge enables us to do more productive work, but our obligations are broadened year after year by the increase in world population and our constantly rising standards of living.

Conservation of natural resources is a way of life. It is wrapped up with goodness and generosity, with morals and life satisfactions. Technology is its servant.

We in Canada need sound farming systems which will maintain and improve soil fertility, if full advantage is to be gained from the other benefits by which we are surrounded. There must be no sub-marginal thinking about the problems involved, or we shall all end up with sub-marginal living. History suggests that a decline in soil fertility is always accompanied by a corresponding decline in the vigour of the people who dwell upon it. Freedom has never flourished in a hungry and impoverished land.

In a mystery story by Michael Gilbert there is mention made of the *Husbandmen's League*, which had an emblem showing two blades of grass, representing thrift, crossed in front of a sickle, representing hard work. The title of this Monthly Letter is taken from Gulliver's Travels: "And he gave it for his opinion, that whoever could make two ears of corn, or two blades of grass, to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together." But let us make them two *better* blades of grass.