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WISCONSIN BANKERS' FARM BULLETIN

FEEDING THE SOIL.

By

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COLLEGE OF AGRICULTURE OF THE
UNIVERSITY OF WISCONSIN



WHERE A PHOSPHATE FERTILIZER GAVE GOOD RETURNS.

Soils, like cows, give best returns when fed a balanced ration. Even manure may not give best results unless supplemented with mineral fertilizers.

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Feeding the Soil

How Do Some Soils Become Exhausted? There are three ways in which a soil may become "exhausted", viz.: (a) by removal of organic matter, (b) by the removal of plant-food elements, and (c) by the loss of lime. On some soils like peat, for example, the removal of potassium or phosphorus alone through one or two croppings makes it unproductive. On most long-cropped upland soils the low yields is the result of a combination of two or all of the above causes.

Some of the early 50-bushel wheat lands are now 15-bushel oat lands. Such soils cannot be renovated in a season by the mere addition of manure, or a little phosphate. These soils work hard; they are lighter in color than they used to be, they bake, and clover fails to grow well on them any longer. Such soils need a tonic, they need "hospital" care; they need more or less feeding.

How May Soils Be Improved? There are several ways in which the producing power of soils may be increased; viz., by adding organic matter and lime, by increasing the supply of plant-food elements, by improving the water supply and tilth. This is not a fixed improvement formula for every kind of soil but it points out methods of attack. A wet marsh needs no addition of organic matter, for that would be carrying coals to Newcastle. A poor sand on the other hand, always has good tilth, and good tilth in this case is not an indication of fertility.

A long-cropped clay loam or a silt loam soil usually requires attention in every particular. What makes it lighter colored than it was twenty years ago? The humus has been largely used up. Why does it work harder and bake? Here again the lack of humus, or organic matter is largely responsible. If the soil is acid and refuses to grow good red clover, it doesn't contain enough lime. If the crop dries up during a short dry period, the water supply is at fault. If the crop is short and the yield is low, when other conditions are favorable, starvation is the cause,—the soil hasn't sufficient available nitrogen, phosphorus and potassium.

What Should be the First Consideration in Soil Improvement? The efforts in soil improvement and in maintaining fertility in upland soils should center around the addition and maintenance of active organic matter; for increasing the organic matter increases the amount of humus; improves the tilth thereby making it work up easier; it increases the water-holding capacity, and makes available or soluble, plant-food elements that have been locked up.

If the soil is acid, liming should be the first step. Lime, like oil to a machine, makes the wheels of fertility operate better. Especially is this true when red clover is to be raised for the humus-producing and nitrogen-gathering crop. Any form of lime that is finely divided and gives the most carbonate of lime for the money may be used. Two tons per acre is a fair average application. Apply on plowed land in the fall, during winter or in the spring. Mix thoroughly with the soil before planting or seeding.

Is Lime Alone Sufficient in Soil Improvement? Don't expect lime to do everything. It won't, and can't. It simply paves the way for the clover, or



ROOTS PRODUCING HUMUS IN A SOIL.

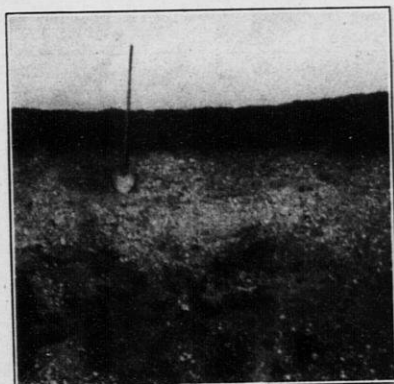
A productive upland soil is well supplied with organic matter and humus.

alfalfa. In case alfalfa is seeded, inoculate before or during seeding to insure a successful crop. If the soil is very poor, an application of manure plowed under will prove exceedingly profitable. It must be remembered, therefore, that liming and fertilizing should go hand in hand in any soil-improvement plan.

Must All Acid Soils Be Limed? On cropped lands in large acid areas where red clover does poorly, and lime is difficult to obtain, acid-tolerant legumes such as cowpeas, hairy vetch and crimson and alsike clover may take the place of red clover or alfalfa in the rotation.

Shall All the Clover be Cut for Hay? It frequently happens that a good stand of clover is secured on poor acid soils from liming and manuring. When the season proves favorable a good clover crop invites dreams of prosperity. Soil improvement is forgotten and a second growth of clover is looked upon as an extra source of hay, or clover seed, when it should be plowed under for the land's sake.

A clover crop plowed under adds nitrogen at the rate of about 40 pounds per ton. Very little or no nitrogen is added to the clover or alfalfa field under normal soil conditions when all the crop is cut for hay. An application of ten tons of manure per acre once in three years adds, or returns, about 100 pounds of nitrogen,—about as much as is required to feed a 50-bushel corn crop and a 30-bushel oat crop. Plowing under some clover, therefore, is necessary to increase the soil nitrogen of that field.



AN EXCELLENT SOIL BUT POOR SUBSOIL.

This soil suffers for want of water in a dry season. Capillary water can not rise through the gravelly subsoil.

What Rotation is Best for Soil Improvement? A short crop rotation should be planned for best results in this building-up process, and clover or some other legume always included. Apply manure at least once in the rotation if it is available. Take the best care of the manure when it is produced. It is valuable. Good average barnyard manure is worth at least \$2.25 per ton for the fertility it contains.

Are Commercial Fertilizers Necessary? Good use of manure and some clover and clover sod plowed under in a short rotation may not give the fullest results desired, even though a good deep seedbed is made and the best of seed is planted. Manure and green clover plowed under may not prove a balanced ration to permit the soil to produce maximum crops. Here soil science should be brought into use to determine what can be used for best results to balance up the manure and clover if the soil seems to fail to supply all the necessary elements. An addition of phosphorus or potassium, or a combination of both these elements in the form of phosphate and potash fertilizers may be necessary.

The heavier soils usually contain a large amount of potassium and hence it is seldom required as a fertilizer. So long as these soils are well supplied with active organic matter this element will become available to meet crop needs. In some cases, however, some potash fertilizer may prove a profitable investment. Marsh soils, as a rule require potash fertilizers.

Some of our Wisconsin soils have had their phosphorus supply already reduced one-half by continuous cropping without fertilizing. Balancing up the manure used on these lands by mixing in it rock phosphate at the rate of one hundred pounds per ton is excellent practice. This can best be accomplished by scattering the rock phosphate in the stable or stalls at the rate of three pints per cow or horse per day. The nitrogen in the manure together with that gathered by the clover plowed under aids largely in producing the stalk and straw; the phosphorus plumps the grain.

Is Fertility Maintained When All Crops Raised are Fed on Farm? All crops remove fertility from the soil, even clover and alfalfa which are heavy feeders on the mineral elements. Legumes, like clover, can gather nitrogen from the air by means of organisms in nodules on their roots; but this fixed nitrogen is removed in the hay, and no increase, therefore, is made in the soil. When the hay is fed and the manure is well cared for and returned to the soil, the nitrogen gathered from the air is brought back, but only about 60% of it; the rest is lost in the feeding transaction. Feeding large amounts of clover and alfalfa hay, therefore, will increase the nitrogen content of the soil on the farm. The phosphorus content can never be increased or maintained by growing crops, feeding them, and returning the manure. In the feeding transaction there is approximately 20% loss of this element. Little potassium is lost when best of care is given the manure and all straw is used for bedding.



A SOIL PROBLEM PARTLY SOLVED.

Liming is the first step in the improvement of a poor, acid soil. Good clover means better sod and more humus.

The soil may be given its nitrogen and humus through the growing and feeding of legumes. Any feeds purchased will also help. The phosphorus that is lost must be replaced by purchase, either through commercial fertilizer or feeds like bran or cotton seed meal. Approximately twenty-seven pounds of phosphorus is removed by a 50-bushel corn, a 30-bushel oat, and a two-ton clover crop in a three-year rotation. Ten tons of manure will return approximately twenty pounds. The deficiency may be made up by adding about fifty pounds of rock phosphate or one hundred pounds of acid phosphate, or by feeding about one-third of a ton of bran or cotton seed meal during the production of these ten tons of manure.

It is good business to keep accounts, and it is good farming to consider the losses and gains of fertility on the farm. The basis of good crops is fertile soil, and a fertile soil is dependent largely upon good stock of humus and a good supply of available plant-food elements it contains.