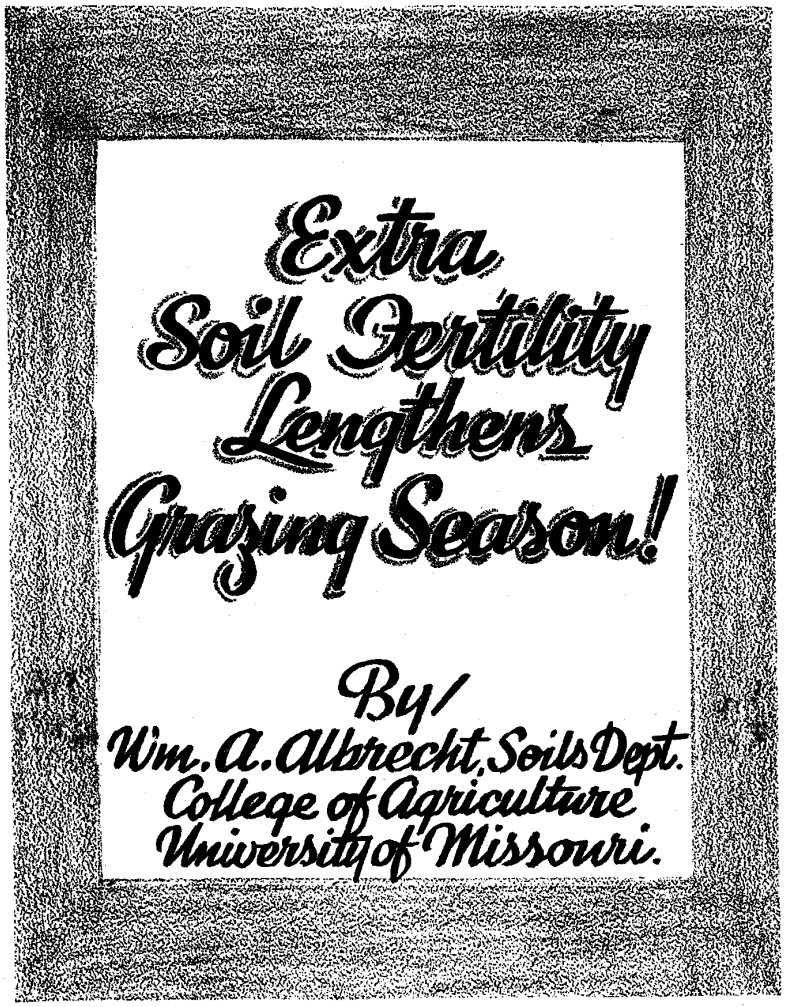

HIGHER costs of milk and meat production have called for the more extensive use of grasses. These needs have called for more harvesting services by the animals themselves. They have brought forth numerous programs for grazing several different crops in sequence as they can be fitted into farm and crop management schemes. Rye or barley of the cereal crops, and sweet clover or red clover as legumes in the early spring; then bluegrass and white clover in their customary seasonal places; Sudan grass or Korean lespedeza in the summer; and the bluegrass and young cereals again in the fall season are examples of such arrangements designed to shift the animals from crop to crop and thereby obtain continual delivery of green forage feed over the longest time.

It is true, of course, that such arrangements provide grazing over a large part of the year. They offset the failure of bluegrass to supply it during a seemingly extended inactive summer period. But the questions may well be raised as to why bluegrass or timothy becomes dormant so soon after spring, and why don't these grasses carry their vegetative periods straight through the drought and heat of midsummer? Haven't these cropping schemes as pasture become a necessity possibly because the fertility of the soil is insufficient in amount delivered to make the individual grass crops and herbage mixtures of earlier times vegetate over a longer season?

GRASSES AS WELL AS GRAIN CROPS ARE CUT SHORT BY DECLINING SOIL FERTILITY

That the soil fertility has been declining significantly has not been generally appreciated. The decline has naturally not been a catastrophic event. It has been occurring slowly, but even that rate may become disastrous in a single generation. This decline is not so readily noticed when the crop is bluegrass or timothy, both of which are commonly considered "easy to grow".

But, nevertheless, the evidences of declining fertility of our soil are accumulating. They are so common that they have not been alarming. They include the fact that the soil is eroding more rapidly than ever. When the soil is too low in fertility to grow cover, to granulate itself, and to hold up in its granular structure against the rainfall, it is the fertility decline that is responsible. Then there are the declining yields of grain, particularly when a state like Missouri shows her acre yields barely holding their own while many new crops of high yields under test are being used.

Another evidence is the shift in nurse crops for legumes. The fertility is going too low to grow the nurse crop and start the legume at the same time. More of the legume seedings are crop failures. These are too readily ascribed to bad seasons, when probably the nitrogen shortage in the soil is responsible, as the "firing" of corn tells us. Then, finally, there are increasing damages from plant diseases and insects, both now coming to be connected more distinctly with deficient plant nutrition, and thereby deficient soil fertility. When such crop irregularities are testifying to the low supply of soil fertility in those soils more commonly put to arable crops, shall we not expect grasses also to suffer from deficiencies when they are on the part of the farm left over after the readily tillable part is put to other crops?

SOILS TAKE A REST

Cropping, even to grass, calls for a continuous delivery of fertility. This delivery is by two assembly lines in the soil One is the microbial decay of the humus or organic matter into which the fertility was compounded by preceding crops. The other is the

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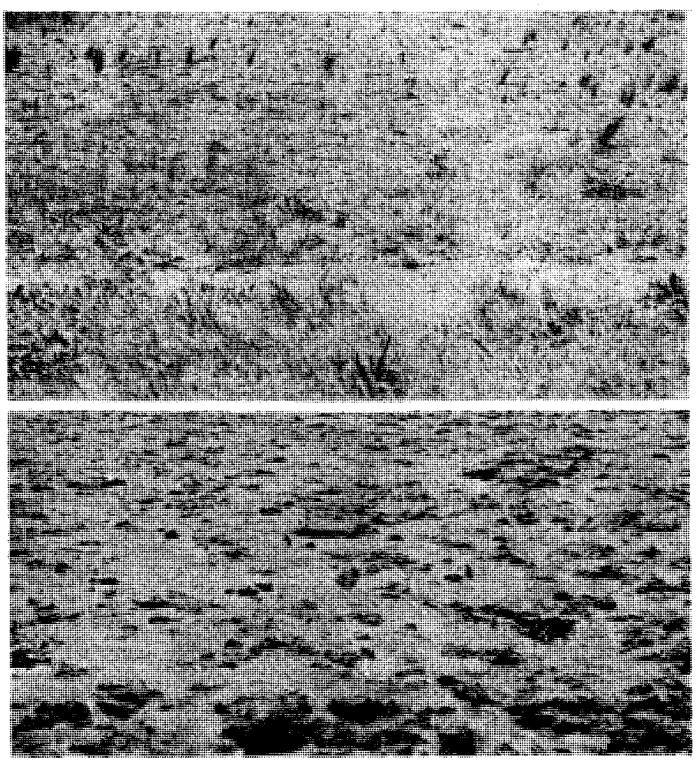


Corn stubble stays bare until late spring except for the threat of some broom sedge where neglect of the soil depletes its fertility. It took only one rain to beat down this soil that was not fertile enough for its body to stand up against. (Photo Missouri Agricultural Experiment Station.)

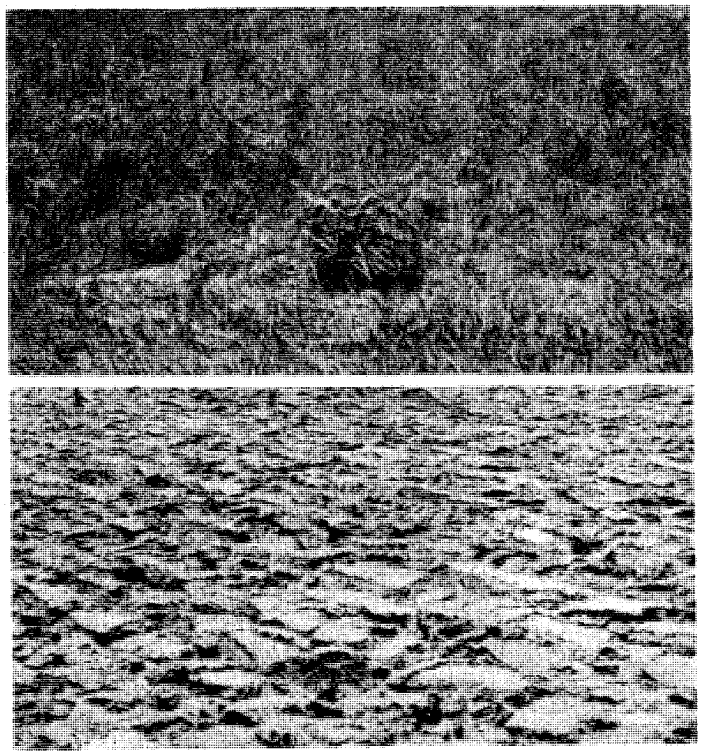
weathering of the soil minerals in the silt and sand separates. As these are chemically broken down, they pass their nutrients to the clay and from there to the plant roots. The plants get their seasonal supply by taking it off the clay quickly as they exchange acid for it. But this clay can't keep on supplying plant nutrients at high speed every year without allowance for "time out" as a means of restocking its stores in soil fertility.

This fact is shown by a wheat plot at the Missouri Experiment Station where wheat has been seeded every year since 1888, the entire crop taken off, and no soil treatment added. Under these conditions the crop yields declined gradually during the early years. In more recent years this plot has produced a crop only in alternate years. After a grain harvest is removed in July, the active soil fertility is depleted too severely to start and carry the October wheat seeding through the winter for a crop. This soil takes a rest literally while the reserve fertility in the mineral crystals or in the remnants of organic matter is put into available form and moved along the soil's assembly lines to the service supply for plants.

Grass failures, in part, or the reduced rates of growth that shorten the vegetative or growing seasons of pasture forages can be fitted similarly into the picture as results of fertility shortage. Grasses, too, depend on these same assembly lines in the soil.

Rotation Not Enough

Much has been said for crop rotations as a means of escaping some of the troubles rapidly brought on by continuous cropping. However, the mere shifting of crops about isn't necessarily a replacement of soil fertility. Grasses put into the rotation with tilled crops are only a reduced rate of fertility removal. They are not a return or addition of fertility. Unless the rotation crops are given soil treatments, even the grasses like timothy pass out.



Extra ferility from regular use of manure grows heavy cover against erosion in the corn stubble, granulates the soil, and helps hold its structure in spite of heavy spring rains after late plowing. (Photo Missouri Agricultural Experiment Station.)

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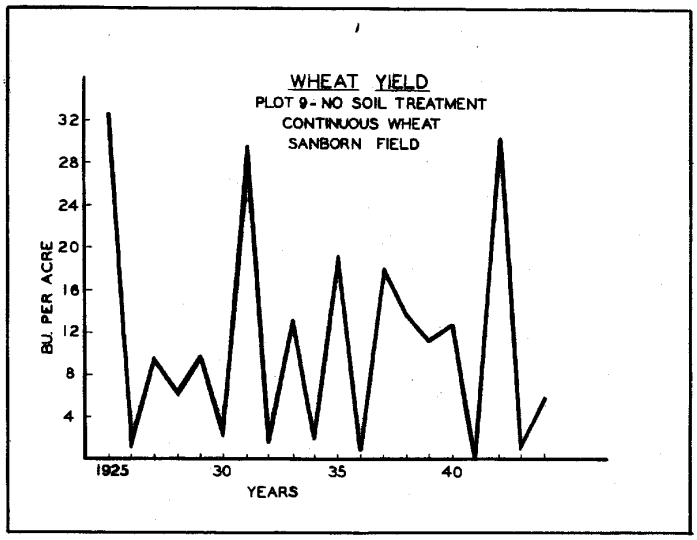
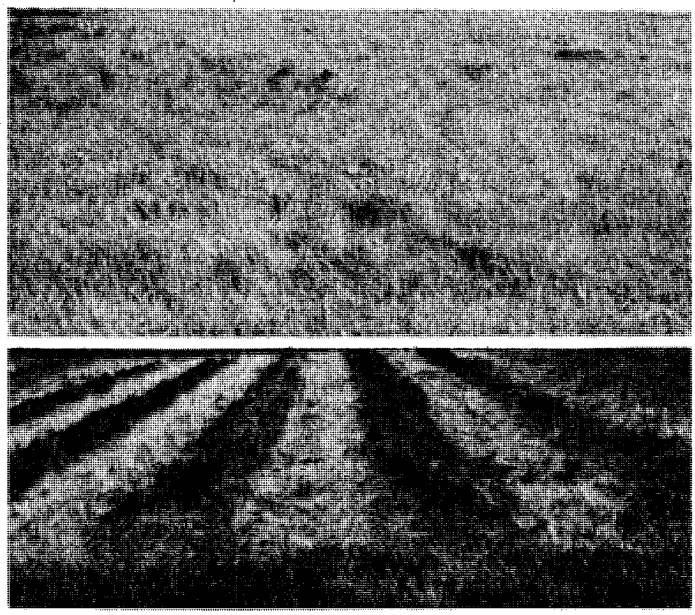
This has occurred in the short span of 50 years under a six-year rotation on Sanborn Field, at the Missouri Experiment Station. Where no soil fertility was returned, the clover-timothy-timothy succession of three years is now a complete failure following after the corn-oats-wheat of the first half of the rotation. Instead of a crop of these forages, it is a crop of tickle grass, which cows would refuse to eat. Before summer arrives, this plot already has scarcely any verdure. Here the grazing period would be very short even in the spring. There is none in the fall. Here the costly clover seeds and the timothy seeds put on as seedings for pasture are truly wasted.

However, on the other plots given some return of soil fertility as different soil treatments, there are pure stands of clover followed by timothy; the vegetative growth carries on later into the summer; it recovers more quickly after mowing for hay; and it stays luxuriantly green long into the frost time. These results are all better as more soil treatments are used in this extensive rotation. Less than nine rounds of this rotation, or less than nine trials of clover, and less than 18 of timothy on this soil where only crop rotation was practiced are soil exhaustion enough to put these pasture crops out. The tilled crops ahead of them survive, but these, for which the soil is unplowed, do not succeed.

Here is testimony that even in such an extensive rotation, with half of the crops consisting of those commonly classified as "soil-building crops," some soil fertility must be added even to keep these growing well enough and long enough each year to represent significant grazing possibilities.



Hungry Soil Rests
After 35 years of cropping to wheat continuously with declining grain yields, this soil began to rest in alternate years as a crop failure. (Photo Missouri Agricultural Experiment Station.)



A crop of tickle grass (lower photo) that the cutterbar of the mower drags down comes in place of timothy in the ninth round of a six-year rotation. Crop rotation without soil treatment has not kept even a grass like timothy. But where manure, limestone, and phosphate were applied in the same rotation (upper photo) the timothy was of good green growth long into the autumn after the tickle grass was dry as tinder.

Soil fertility is often too low to start the legume crop while growing its nurse crop. Clover success in the center resulted from an early removal from the plot border of the nurse crop (wheat) competing with it for nourishment by the soil. (Photo by Missouri Agricultural Experiment Station.)

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This is evidence that mere crop rotation is not enough, even for the grass crops that survive without seed production or that plant process which makes the particular demand on nutrients from the soil. Grasses, too, require added fertility as soil treatments to keep them up as grazing crops during a long season.

Balanced Fertility is Required

Naturally farm manure is the age-old top dressing for pastures. This supplies nitrogen and encourages luscious green vegetation. It supplies also significant amounts of potassium, commonly associated with photosynthesis, or with the fabrication of carbohydrates from air and water by sunshine energy. That lime is helpful to grasses has not been widely appreciated. This plant nutrient functions in mobilizing other nutrients into the plant. It serves the plant seemingly in helping it take many other nutrients more effectively from the soil. It also encourages microbial activity whereby the organic matter is more actively broken down. This may provide more nitrogen.

Lime has helped to extend the growing season of grass farther into the autumn. It has aided in getting the grass off earlier in the spring. Such effects are not the regular rule, however, unless organic matter is built into the soil to be broken down by the help of the lime. All of these facts point out that even for grass, which is not commonly considered a soil depleting crop, does not last forever unless the fertility of the soil is maintained.

Both Crop Shiftings and Fertility Are Needed For Extended Grazing Season

Because grass crops look good in their green color and keep the ground covered, we are not apt to measure their production very accurately. Then too, they are not measured in terms of amount of seed, the production of which reflects the delivery of nutrients by the soil more distinctly. Still further, most grasses fluctuate widely in chemical composition, at least in those elements contributed by the soil. Consequently such crops may be making bulk from air and water and hiding the shortages they suffer of those nutrients that are soil-borne. When this occurs, the animal grazing them may be suffering shortages, too, not only in days of grazing season but in nutritional quality of the feed. After the soils have declined in fertility, the mere provision of a long season of grazing by growing many different crops in sequence on them may merely aggravate these feed deficiencies.

However, when any one grass crop extends its own growing season over longer time than usual, it is highly suggestive that fertility is being liberally provided. It also intimates that the plants may be making more nutritious feeds as a result thereof. After all, it is the soil that lies at the foundation of grass growth. It is the fertility of the soil that must be considered in terms of soil treatments for giving a long and profitable grazing season whether of one crop or of many in specially arranged combinations or sequences. Nutrition of the grazing animal must be built from the ground up.

(Reprinted from Guernsey Breeders' Journal, August 15, 1946)

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