AGRICULTURAL ENGINEERING

No More Straight Furrows

The Farmer Has Broken Age-Old Tradition, Plowing In Curves as New Weapon Against Soil Erosion

By DR. FRANK THONE

CROPS are in; it is winter now. Cornshocks dot the fields; down in Dixie the last of the white-loaded wagons have creaked to the cotton-gins. Through the stubble-fields the farmer has driven new furrows, preparing the land for yet another crop.

But look at the fields for a moment. Those are strange furrows he has plowed. For they break with a tradition so old that it seems to have come down from old Farmer-Grandfather Adam himself. They are no longer straight furrows.

Straight furrows used to be every self-respecting farmer's greatest pride of craftsmanship. The more nearly he could lay his field out as though with a yardstick the better he was spoken of by his neighbors—and thought of by himself. A crooked furrow was a weakness—even a sin. The line of the plow must run as undeviating, as dogmatic, as relentlessly orthodox, as the Puritan doctrine the farmer heard from the pulpit on Sunday.

Was the land level and even? Well and good: that made a straight furrow the more easy. Were there hills and hollows? Over them, through them, in a straight line! Aught else was slipshod work, likely an offense to Jehovah, certainly a mocking to the neighbors. The furrows must be straight, straight, straight!

But what was Grandson doing, driving these curving, winding furrows around the side of the hill, instead of going boldly over it? Has he grown soft, degenerate? Is he no longer worthy to be the master of the acres? No longer a real farmer?

Tradition Poor Guide

Not at all. He has only learned in this, as he has learned in other things of late years, that tradition is not necessarily a sure and safe guide, that the old ways are not certainly the best ways.

That they may even be the worst ways. That by following the fashions of his fathers he may actually be robbing his sons. Robbing them of the land his fathers strove, almost starved, to get, that he has sweated through lean years to hold. Land that he has suddenly seen slipping away literally from beneath his feet, taken by a foreclosure more remorseless and beyond redemption than anything that could be imagined from the harshest laws, the most grasping money-lenders.

Erosion Conscious

For within the past half-decade the farmer has suddenly become erosion-conscious. He knows now the insidious enemy that perverts his ancient friend, the rain, and uses it to work his ruin. And he is coming to see that straight furrows, his traditional habit, almost his religion, have played straight into the hands of the enemy, hastening the eating away of his best soil, the wastage of the fertile top layer, the devourment of the slopes by gaping gullies.

He has seen it, and we all must see it, though the feet of some of us never leave bright-lighted pavements. If we do not see it, and in some way put all our hands to the plow to prevent it, we shall presently find ourselves a nation without bread.

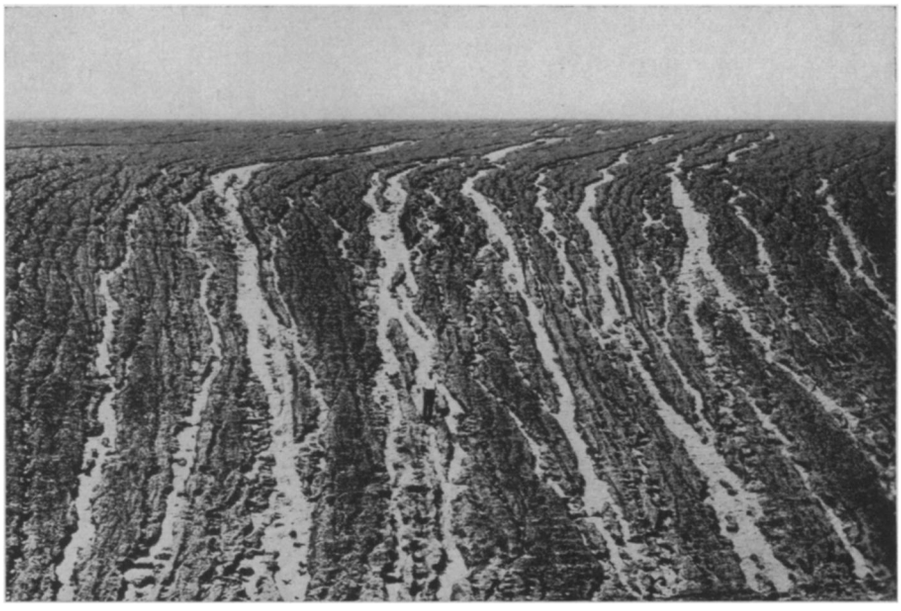
In the face of a great national peril in ancient Israel, there arose a great prophet, who even while he warned of doom also held out a promise of rescue, if the people would only hear and act: "Behold, *now* is the acceptable time!"

In modern America, faced with a national peril even more grave than the swords of the Assyrians, there stands in our midst not one prophet but a whole army of prophets. They also tell us that "Now is the acceptable time," and warn us that tomorrow it may not be. They are not mystics like Israel's prophets, but their vision is not less sure, for they are the men of science, and they know whereof they speak.

Saving Our Daily Bread

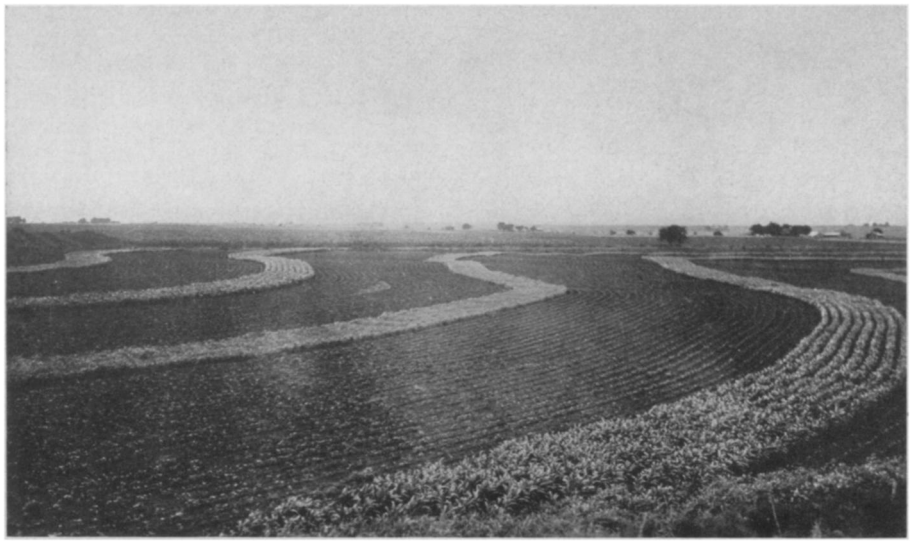
It is they who have taught many farmers to plow curving furrows and to do many another thing that their forefathers would have thought useless or even mad. It is they who will show us the way to national salvation of our land, to the final insurance of our daily bread.

To be sure, they do not look or talk like prophets. (But then, if you could have stood in the market place of Old



STRAIGHT FURROWS: DEATH

A torrential downpour of rain on land plowed in straight furrows may produce the desolation shown in this picture. An idea of the size of the paths of destruction is given by comparison with the size of the man standing near the center of the picture.



CURVING FURRROWS: LIFE

Where ground is sloping, plowing in lines conforming with the contours of the land prevents erosion.

Jerusalem, probably Isaiah wouldn't have looked much like a prophet, either.) These prophets of the new dispensation in land do not even look like the conventional picture of scientists. They are young men, they wear old clothes, and they talk like farmers.

There is dirt on their shoes. They glory in the epithet "dirt scientists," and in appearance at least they are indistinguishable from the "dirt farmers" among whom they work—who are, indeed, often their own blood kin and neighbors.

To do justice to history, it must be remembered that this New Deal in land use antedates the New Deal in politics. It was a commission appointed by former President Hoover that first investigated the peril of soil erosion, and sounded the warning aloud over the land. Under President Roosevelt their activities were propagated broadcast, until now there are about forty different soil conservation projects on which they work, with at least twice or thrice as many more in process of development. The map of the United States is already dotted with them; a year hence it will be peppered with them.

Two Phases

Water erosion of soil, which these men live to fight, works its mischief in two principal phases. When the surface has been stripped and laid bare, whether through over-cultivation, over-grazing, or reckless removal of trees, the first phase of destruction is the gradual disappearance of the topsoil. The appearance of the surface may not change much, but inch by inch through the decades and generations the rich soil that best nourishes the crops grows thinner and thinner. This phase is called sheet erosion. There are many, including many farmers, who do not know sheet erosion because it is hard to see, and who will even deny that it happens.

But no one can deny the reality of the next phase, gully erosion. The least-educated "city feller" can see that. That sets in when little runnels of rain start cutting through the surface and making tiny canyons across the field. The loose soil, no longer bound by roots of grass or trees, yields easily, and presently the miniature canyons are magnified a thousand-fold, and the hungry gully gnaws and gnaws at the side of the field, like the vulture at the side of Prometheus.

Fertility Decreased

Along with erosion goes loss of fertility. Crops become less per acre even while the acres themselves shrink. At last arises a generation of farmers who suffer for the sins their fathers unknowingly sinned against them: there is failure, foreclosure, another abandoned farm, another family drifted to the city "on relief," helpless feeders instead of providers of food.

The counter-attack of the "dirt scientists" follows many lines. If you stop at one of these nests of erosion-fighters and get acquainted with the personnel, you discover quickly that they are not all alike. One will be a soil specialist, another an engineer, a third a forester, his neighbor an entomologist. Each knows the weaknesses of the land he is defending, each can contribute some element of strength. The counter-attack is as complex as the attack of a modern army, with its aircraft, its tanks, its artillery, its machine-guns, its infantry, and all the rest.

There is something quasi-military, as well as something of the prophetic, about the activities of these erosion-fighters. (Some of Israel's prophets were soldiers, too.) They study the problem imposed by the presence of the enemy, they consider the most effective and economical means to thwart his activities, they set their strategy into action.

Hills the Key

Like soldiers, much of their combat consists of digging in the dirt. Like soldiers, they undertake to hold the hills. But unlike soldiers, they do not get on top of the hills and try to prevent the enemy from coming up. They get on the sides and bottoms of the hills, and their endeavor is to prevent the enemy from coming down.

Water, and the torn earth it carries with it, chooses the straightest road down the hill. Here is where the treasonableness of straight-plowed furrows come in. They are often ready-made beginnings of gullies; all erosion has to do is widen them.

To thwart erosion, the defenses must lie across its path, just as military defences must lie across the path of the enemy. Hence the curving furrows. They follow the "contour lines" of the slopes, so that they are always at right angles to a line drawn at any point from top to bottom.

Breaking the Force

And as the furrows run, so run the crops that follow them. Sweeping on the long curves around the hill, they everywhere oppose the stubborn insistent hold of roots in the soil to the straight down-charging little streams of water. They deflect them, break their force, turn them again into allies rather than enemies.

Further strength is gained by alternating the easily erosible "clean-cultivated" crops like corn and cotton with sod-forming strips of grass and clover, or long-rooted, close-set crops like sorghum. This is called "strip-cropping." This also introduces a new element into the farm landscape. No more endless fields of the same crop, but (where conditions call for it) alternating bands of two, three or more kinds of plants in the same field, like a piecework quilt. It looks queer, but it is better farming.

One farmer, after he had got the hang of contour-plowing and strip-cropping, said to the Government man who had suggested it to him: "Well, at least

I'll not need to take a jug of drinkin'-water to the field with me; all my furrows will end near my pump." In his particular case this was nearly literally true, for his farm stood out on the end of a jutting hill, and he had to plow horseshoe-shaped strips back and forth.

A step advanced beyond strip-cropping is the building of terraces. These are imperative on steeper slopes, desirable on almost all slopes. Terraces, have, indeed, been used a good deal in parts of the South, but as yet have not taken much hold elsewhere. The erosion-fighters are experimenting with various soil types, in different parts of the country.

Not New

Terraces are nothing new in farming. Indeed, they are among the oldest of farming devices—so old that their origins have been forgotten. But you find them everywhere: all through the Orient, in the ancient lands of the Incas, on the steep slopes of the Rhine and Moselle where the famous vineyards are that the Romans first planted. The mysterious "lychets" of English hillsides may have been cultivated terraces in the New Stone Age, ten thousand years ago.

Terraces take time, and at least a little expense, to build. But once built, their flat tops are almost erosion-proof, and their steep sides are given to grass or other permanent vegetation, to hold them in place. At the ends, where the runoff waters must drain, wide runways are left, and long grass is encouraged to grow in these so that the water may slide over without cutting the earth loose and starting another gully.

New Hope

With contour-plowing, strip-cropping and terraces, then, the fields may be redeemed. The gullies, hopeless-looking rents in the earth, next challenge.

Here the engineers and foresters enter the fight. In the deepest and most menacing pits, the engineers throw in dams: stone where they must, though that is laborious; earth fills, or stakes-plus-wire-plus-brush, where they can. These obstructions slow down the water, permit the silt to deposit and fill up the holes. Maybe the sides are scraped or dug in a bit. What once was a deep, angular gash presently becomes a shallow, curved swale filled with marsh-grasses and cattails—a very much friendlier place.

While the engineers block the main gully with dams, the foresters attack the flanks with roots. They plant trees along the sides, trees with long, fast-growing roots that will hold the soil and prevent the gully from growing wider.

A favorite species is black locust. It has the right kind of spreading roots, it "suckers up," forming dense thickets, it eventually makes good post-timber (if the borers will only let it alone), its feathery foliage permits grass to grow underneath, it is a legume, enriching the soil. Plainly, a tree of many virtues.

Erosion's fight against man has gone on almost unnoticed since pioneer days. Man's fight against erosion has just begun. Whatever the future political vicissitudes this country may face, this is the one of the newer Government activities that simply must go on. If it is stopped, presently there will be no land for either conservatives or radicals to govern at all. The rest of our farmers must be converted to the Curving Furrow. In this sign they shall conquer.

Science News Letter, December 7, 1935

GEOLOGY

Artificial Lava Currents Show What Happens in Earth

A UNIQUE device for the study of the behavior of rocks and molten lavas in deeper parts of the earth's crust has been designed by Dr. Robert Balk, chairman of the department of geology and geography at Mount Holyoke College, and built especially for him with funds from the Carnegie Institution of Washington. Research along this line is expected to reveal interesting and hitherto unknown facts concerning the origin of certain deposits of ore minerals, especially chromium, nickel and iron oxide magnetite.

The machine consists of a series of tanks about six feet long through which flows a current of artificial magma or molten lava. Hundreds of solid particles are suspended in the magma to simulate the crystal grains that float in the real magma reservoirs forty miles below the earth's surface. Obstructions are then placed in the path of the current, so that the floating grains must converge, accumulate or diverge in the same way that the actual crystals do below the earth's crust.

The process is similar to the formation of streaks of smoke or dust behind a moving automobile or to the development of foam trailers behind a moving steamer, and is believed to have a bearing on the origin of certain deposits of ore minerals.

In explaining the operation of his machine, Dr. Balk pointed out that the movements of molten masses, involving thousands of cubic miles of material erosion, have laid bare the surface of these enormous intrusive magmas. This is because millions of crystals that were kept afloat in the molten mixture register after erosion the directions of movement by lining up in the fashion of trailers parallel to the directions of elongation. The mechanism of this entire process is reproduced on a small scale by Dr. Balk's machine.

Another device recently built by Dr. Balk illustrates the manner in which fractures accompany folds and similar deformations of the earth's crust. Only two similar experimental devices, one at the University of Bonn in Germany and another at the Johns Hopkins University, have been constructed so far. The machine consists of a cake of wet clay stretched over a double sheet of tin. Through variations of the intensity of stretching and of the consistency and thickness of the clay mass, Dr. Balk will be able to imitate accurately a number of natural processes of rock-strata fracturing.

Science News Letter, December 7, 1935