Contour farming for soil and water conservation

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Contour Farming for Soil and Water Conservation

BY C. H. VAN VLACK AND L. E. CLAPP

In order to keep Iowa soils from becoming less fertile and from being washed away, it is necessary that every farmer develop and carry out a program of soil and moisture conservation for his farm. This program need not be complicated. Any Iowa farmer can, by following practical methods, keep his soil fertile and in place.

Every acre of a farm should be planned to produce its maximum income in whatever crop it is adapted to produce. Soils on level areas can be kept fertile by proper crop rotation and necessary soil treatments. Rolling land should be handled the same way except that as it becomes steeper other practices must be adopted to keep the soil from washing away. Some lands must remain in pasture, while those less fertile areas which are becoming eroded should be planted to trees.

Many rolling Iowa lands farmed to intertilled crops are losing topsoil in spite of the use of long rotations having the minimum amount of intertilled crops. Other practices, such as contour tillage, strip cropping and terracing, are being recognized by Iowa farmers as necessary and practical. These practices alone will not solve the problem of soil and water loss. By combining all of the necessary principles and practices of soil and moisture conservation as they apply to each individual farm, Iowa land can be kept productive.

EFFECT OF TERRACING, STRIP CROPPING AND CONTOUR FARMING ON LABOR AND FUEL REQUIREMENTS

Measuring labor and fuel required to work terraced or contoured fields, as compared with the same fields worked in straight rows, is almost as difficult as measuring the changes in the speed of erosion. Until carefully controlled studies can be made, estimates of farmers appear to be the best approach to an appraisal.

Gullies—those earth scars which cut large fields into small, irregular, hard-to-farm patches, reduce the value of farms and menace other farm land and farm livestock—are becoming thickly populated on the Iowa landscape. Gullies are the product of years of uncontrolled runoff water which has dug deeper and deeper into once fertile, tilled fields, as this gully on a Decatur County farm.

No attempt is made to fill most gullies of this size, but efforts are made to keep them from becoming larger and more destructive to other lands. Fencing such a gully and planting it to post and wood-producing trees as well as to food-bearing and protective shrubs for wildlife are the best controls of the gully itself. Land above the gully could be contoured to prevent further water from entering the gully when cultivated crops allowing high runoff of water are on the field.

Regarding the effect of contour cultivation on horse labor, 92 percent of 197 farmers interviewed reported that farming on the contour made work easier for the horses, and 84 percent stated that this more than offset any extra time used.

In general, these replies indicate that where horses are used, there may have been some increase in the time required to work fields on the contour, but this was offset by the elimination of up and down hill pulling. A large number of the farmers felt that on contour and strip cropped fields the consumption of tractor fuel had been reduced, while on the terraced fields the number reporting a fuel decrease was offset by an equal number reporting an increase. More labor was required on contoured or strip cropped fields on about one-
Not all farms are well suited to a full and complete use of the contour method because of very irregular slopes necessitating sharp curves in the rows. However, it is possible to lay out many difficult areas with surprising success. All of the cornfields of this farm of E. H. Stevens of Farragut, in Fremont County, are planted on the contour.

Terracing supported by necessary cropping practices is primarily applicable on sloping lands that must be used for crops and on which less expensive conservation measures will not provide adequate erosion control. Terracing should not be considered for land that can be kept under permanent vegetative cover, except possibly where terraces may be required for moisture conservation or diversion of water for gully control or as aid in establishing permanent vegetation. Where erosion can be controlled through contour tillage, crop rotations and strip cropping, terracing is not necessary.
third of the farms according to the farmers; 10 percent reported a decrease. On terraced fields over 40 percent of the farmers reported an increase in labor requirements, and very few reported any decrease.

SPECIFIC DIFFICULTIES REPORTED BY FARMERS

Apart from an increase in labor which may result from terracing and contour farming, several additional difficulties were reported.

The two major difficulties encountered were weed control and turning in the fields. In the two pasture areas (South Central and Southern) about half of the farmers with contoured or strip cropped fields reported difficulty in controlling weeds when the corn was not check rowed; in the western livestock area the percentage of farmers facing this difficulty was much smaller.

OPERATING OVER TERRACES

Mr. R. A. Norton reports: “On all terraced land on the Soil Conservation Experiment Station farm near Clarinda, Iowa, we have used the standard corn belt rotation of corn,

This field in Page County is being cut up with hillside ditches. This might not have occurred if good farming practices had been used in past years. Too many consecutive crops of corn planted and cultivated without regard to slope, with too little addition of water-absorbing organic matter, has resulted in a condition which allowed water to run off quickly, taking soil with it and causing ditches and gullies.

The use of systematic crop rotations, the addition of organic matter and the contour growing of crops are some of the necessary practices for Iowa farmers to follow if they are to protect the land which they farm.

Norton, R. A. Results of experiments on terraces and terracing at the Clarinda (Iowa) Soil Conservation Experiment Station.
This Jackson County farm has no unsightly ditches or gullies but wide, hay-producing waterways. For years this farmer allowed no one to plow this area to plant corn, for he knew that in a few years an unsightly gully would develop. Care was taken to keep the waterway wide, not allowing ridges which might result in side ditches.

Contouring of cultivated crops allowed the excess water to flow slowly into these protected outlets which can also serve as terrace outlets. Care must be taken to protect such waterways from gophers, etc., because water concentrating in the rodent holes may cut out and develop ditches.

Contour drilling corn with furrow opener attachment on terraced land where 8 tons of sweet clover green manure had been turned under.

Mr. Farley Henkes, Farmersburg, Iowa, is plowing corn on the contour. He told a group of visitors, "This is my first experience with contour work. I have not hooked up to any piece of machinery which does not work better on the contour than it did the old way, up and down hill. I can see that this method is saving my soil."
Checked corn, cultivated up and down the hill provides an excellent condition for erosion to leave its marks of little ditches along the rows.

Much more power is required for tillage when operations are up and down the slope. These slopes are quite typical of those which lend themselves most readily to contour farming. It may be noted that the pasture slope in the background is becoming badly ditched and gullied. That is glaring evidence of the loss of practically all the fertile topsoil. Apparently there is still good topsoil left in this cornfield which could be conserved if all the field operations were conducted on the contour. Grassed waterways should be established in this cultivated field at once.

Since this picture was taken, the owner, Fritz Black, Crawford County, has reorganized the field layout on this 290-acre farm, and all operations are now on the contour.
Leland Roberts, Marion County, is plowing on the contour above a permanent buffer strip. This plowed strip will be planted to corn. Plowing across the slope is an important part of the best farm practice. In Iowa the counties, townships, highways, sections and fractions of sections were generally surveyed on rectangular lines. This has developed the custom of fencing fields on similar rectangular lines and plowing parallel to the fencing which causes many furrows to extend down slope, making channels which hasten runoff. The better practice is to plow with the contour, rather than up and down the slope, so that the furrows are at right angles to the direction of the flow of the surface water, serving as obstacles to runoff. This promotes retardation and infiltration and causes sheets of water to deposit the soil being carried.

Furthermore, much less power is required to do the field operations on the level than up and down the hill.

corn, oats and clover. This has given us an opportunity for a study of many different types of farm machinery. Ever since the establishment of this station observations have been in progress on the possibilities and difficulties involved in the operation of machinery over terraced land. While, in general, the slopes are long and regular and the terraces have long, sweeping curves, the slopes are steeper than on several of the experiment stations in other regions. It has been found that almost any implement which has a span of operation of about 10 to 11 feet can be operated quite satisfactorily on the land in this region. We have used three-row equipment for the planting and cultivating of corn, and finally have evolved a terrace cross-section on which such equipment will operate satisfactorily.

"It has been thought that if three-row equipment could be made to operate satisfactorily, it would not be difficult to use two-row machinery—. We have found some difficulty
This farm level has the advantage of being simple. No engineering or technical skill is required to use it, because it is practically self-leveling. The line of sight is across the top of two vertical columns of liquid which are connected and therefore are always level. A further advantage is that the field of vision is not restricted. This level, developed by Price Grieve, Denison, Iowa, has been used in practical farm contour layouts.

In the operation of planters and cultivators following each other where the flexibility of the planter was in a plane parallel to the direction of travel of the tractor while the cultivator was free to rise and fall in a plane perpendicular to the direction of travel of the tractor.

"It has been observed that operation of machinery on the contour in this vicinity is quite advantageous. For example, it is found unnecessary to shift gears while operating a tractor on the contour as compared to the necessity for frequent shifts when going parallel to the fencelines, and therefore up and down hill. Even more important than this is the observation that when seepy places occur on hillsides they outcrop on contours, so farming the field on the contour permits the operator to keep his rows always above or always below this seep outcrop. In wet weather the upper part of the field may be handled by itself and no turning in the middle of the field is necessary as would be the case when the seep contour is encountered where the rows are planted parallel to the fenceline."

**LAYING OUT BASE (GUIDE) LINES**

The first contour base line (guide line) should be laid out near the top of the slope, possibly from one-fourth to one-third of the way down the hill. Stakes should be set at about 100-foot intervals except on curves and through draws where
closer spacing should be used. The "Walking A" may be used or some type of inexpensive farm level. Great precision is not necessary as is the case in laying out terraces or drainage ditches.

After the line of stakes is set essentially on the level, a back-furrow should be plowed on this line, driving so as to make a smooth curve from stake to stake, thus establishing a rather permanent contour base line which will serve for a number of seasons. Likewise a second base line farther down the slope, and sometimes a third if the slope is long, is laid out and marked by back-furrowing.

Contour tillage is the practice used to save soil and water on a sloping field by plowing, planting and cultivating around on the contour level instead of up and down the slope. Then each row and plow furrow acts as an obstruction to the downward rush of runoff water. T. J. Beeson, Montgomery County, is cultivating his corn on the contour. He lifts his cultivator on the grassed waterway and uses the waterway to make a sharp turn.

In contour farming each mark of a farm implement used in preparing, planting or cultivating provides a small channel and ridge which holds the rainfall for a short time, allowing more of it to soak into the soil.

Because there is certain to be some runoff during excessive rainfall periods, the natural waterways should be protected or gullies will result. Good bluegrass sod should cover these drainageways, which should be at least 25 feet wide. The lay of the field will determine the location and number of grassed waterways.

The corn rows on a hillside should not be perfectly level but should drop slightly downhill to provide drainage into the waterway. If that provision is not made there is danger of "breaking over" during heavy rains and ponding during rainy seasons. A few inches fall per 100 feet is desirable. Excessive washing in the rows may follow if the grade is much greater than 1½ to 2 percent (1½ to 2 feet vertical fall per 100 feet horizontal). Therefore, correction lines should be established as required.
This field was prepared for corn by working up and down the hill. The average frequency of gullies is 54 inches; average depth of gullies, 6 inches and average width of gullies, 9 inches. These gullies resulted from 2.2 inches of rain in 6 hours; 2 inches of which fell in 2 hours.

In contour planting it is often necessary to "start over," setting a new or true contour base. Where these construction rows meet or head into the first contour series, a turn area is formed which is not necessarily lost or destroyed by turning.

Fields planted to corn in an "up and down hill" fashion are likely to lose much topsoil, particularly during the season when the soil is loose from cultivation and when there is little vegetative cover. This field in Clayton County had much of its soil moved from the hillside to the bottomland by an early June rain causing evident damage to the crop in the bottomland. Much Iowa land is losing its topsoil in a similar way. Fertile bottomland soils become covered in time with the poor subsoils from the hillsides.

Had this corn been planted on the contour much less soil loss would have occurred, the rainfall would have had more chance to soak into the ground and crop damage would have been eliminated.
This contoured portion of a field of corn on the Chris Jensen farm, Audubon County, produced 20 bushels higher yield in 1939 than a portion of the field of equal fertility and similar topography drilled and cultivated up and down the slope. The corn rows running cross-wise to the slope as illustrated saved all of a 2-inch late summer rain, while the other area lost most of that rainfall as runoff besides much of the best topsoil.

This corn was very clean, showing that it is possible under proper conditions to keep down weeds in cultivating contoured corn where checking cannot be done. Again, it was demonstrated that curved rows could be harvested for the silo without appreciable waste or inconvenience.

Distances between the contour base lines may vary from 50 to 150 feet, depending upon the irregularity of the slope.

When planting is started, even though the base line is used as a guide, some deviation should be made so that the rows will slope to the natural protected drainageway (grassed waterway). This grade should be slight.

Starting with the first base line, work out the area above to the top of the hill. Next, work down from the base line until the direction of the rows varies from the desirable contour line of a slight slope to the natural drainageways. The rows may be developing too much slope into the drainageway, or they may have a slope away from the drainageway which is undesirable.

In like manner work from the second base line until the area above it is worked out. Some point rows or irregular areas will occur. These areas may be planted with a different crop to avoid point rows or planted with the same crop.
CONTOUR FARMING REDUCES SOIL AND WATER LOSSES AND INCREASES YIELDS.

<table>
<thead>
<tr>
<th>Direction of row</th>
<th>Inches rainfall runoff</th>
<th>Tons of soil lost through erosion</th>
<th>Year</th>
<th>Bu. per acre</th>
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<tbody>
<tr>
<td>Rows down slope</td>
<td>19.00</td>
<td>195.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1933</td>
<td>33.11</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1934</td>
<td>1.80</td>
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<td></td>
<td></td>
<td>1935</td>
<td>13.24</td>
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<td></td>
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<td>1936</td>
<td>3.76</td>
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<td>1937</td>
<td>30.33</td>
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<td></td>
<td>1938</td>
<td>24.84</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1939</td>
<td>25.40</td>
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<tr>
<td>Rows across slope (contoured)</td>
<td>2.76</td>
<td>36.44</td>
<td>1933</td>
<td>56.11</td>
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<td></td>
<td></td>
<td>1939</td>
<td>39.40</td>
</tr>
</tbody>
</table>

Total rainfall—176.34 inches.
Slope 9 percent. Clarinda Station. S. C. S.—U. S. D. A.

These results obtained on the Erosion Experiment Station farm show that during a period of 7 years, contour farming practically eliminated the rainfall runoff. The soil loss was reduced from 195 tons for the period to a little more than 36 tons per acre. The corn yields on these plots were increased each year except 1938, with larger increases in bushels per acre in the more favorable crop years of 1933, 1935, 1937 and 1939.

Results show that as the rainfall is held on the land and absorbed by the soil that crop yields are increased and soil losses reduced.

This contour lane on the Guy Culver farm, Greenfield, Iowa, has been laid out to follow the ridge.
CONSTRUCTION AND USE OF “WALKING A”

The construction and use of the “Walking A” is simple. Constructed of three 1x4’s, 10 feet long (other lengths can be used), the crosspiece is fastened to the legs at an equal distance from the lower end of each and at such a height that the spread between the legs is approximately a rod. Bolting the pieces together rather than nailing is recommended to facilitate knocking down for transportation.

An ordinary carpenter’s level of reasonable accuracy is fastened to the crosspiece. The “A” can be handled by one man, but two men do the job more easily.

The first step in running a line is to locate the starting point. When being used as the basis of contour cultivation this position will be about a third of the way down the slope of the field.

The A is leveled by moving the forward end up and down the slope, keeping the rear end stationary, until the bubble stops on center. The instrument is then carried forward until the rear leg can be placed on the exact spot where the forward end rested, and the operation of leveling is repeated. Stakes are set at frequent intervals, depending upon the lay of the particular field. Every five or six lengths the A is reversed to compensate for accumulated errors in the level itself.

If drainage is desired in the line, the necessary fall can be obtained either by wedging the level or cutting one leg shorter than the other. If the distance between the center of the bearing points of the legs is a rod (16½ feet), removing ¾ inch (vertical) from the leg will cause the line to have almost 5 inches of fall in 100 feet. If this adjustment is made it is always necessary to carry the A in the same direction while running a grade line. In this case the A must not be used as a Walking A.