Following the contour (How to strip-crop Iowa land)

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FOLLOWING THE CONTOUR

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Cover photo courtesy Soil Conservation Service, U. S. D. A.
Following the Contour
(How to Strip-crop Iowa Land)

By J. B. Peterson and L. E. Clapp*

Many Iowa farmers are now farming around the hills instead of up and down them. The results of many investigations have justified for some time this practice as a soil- and water-conserving measure, but until comparatively recently there was little contour farming practiced in the state. Since contour farming has been adopted on many Iowa farms in the last few years, its value under real Iowa conditions can be appraised on the basis of actual experience. "The proof of the pudding is in the eating," according to the old English proverb, and so it is with contour farming. Farmers have found it to be a wise and feasible practice as shown by the fact that only a very few of those who have given it a fair trial have abandoned it.

The reasons why contour farming helps to conserve soil and water are obvious. Every row running around the hill acts as a little barrier which checks the velocity of the surface runoff, causing it to unload its silt and to flow more slowly from the land so that more of the water will have time to soak into the soil. Strips of close-growing, soil-binding crops, planted alternately between strips of contour row crops, likewise lessen the amount of the slope exposed by the clean tillage. The close-growing crop will check the velocity of any runoff from the cultivated strip above and cause it to drop its load of silt. The soil covered by the soil-binding crop will be held against erosion, and the continuous extension of rills and gullies through the field will be checked.

There is little question any more about the effectiveness of contour farming as an aid to erosion control, but many questions arise as to the best methods for laying out the fields in order that ordinary farming operations can be done on the contour.

The purpose of this bulletin is to describe that phase of contour farming known as strip cropping.

* The authors acknowledge the assistance of technicians of the various work units of the Soil Conservation Service in Iowa.
Fig. 1. A section from a contour map showing how contour lines spread apart where the slope is gentle and come close together where the slope is steep.

EXPLANATION OF TERMS

Many terms have come to be associated with contouring. Some of the words have different shades of meaning in different sections of the country. For the sake of clearness we shall explain the meanings of some of the terms used in this publication.

A Contour Line: A contour line is a line connecting points of equal elevation. Consequently a contour line must be level. It will swing out around the ridges and run back up into the waterways like a road laid out on the level or like the water line of a lake shore. Where slopes are uniform, contour lines will be parallel to each other, but where slopes are irregular contour lines will come close together in some places and spread apart in others according to the lay of the land. A look at the contour map (fig. 1) reveals that contour lines come closer together where slopes get steeper and spread as slopes flatten.

This can be shown in another way. In fig. 2 the ground exposure between the 10-foot contour interval is about 35 feet
where the slope is 30 percent as compared with only 19 feet where it is 60 percent.

**Contour Farming:** Contour farming is the carrying out of all farming operations on the level on rolling land by operating parallel to reference lines laid out on the contour. It is farming around the hills rather than up and down them. All farming practices carried out on the contour, such as strip cropping, contour tillage, terracing, the use of correction strips, etc., may be considered types or phases of contour farming.

**Contour Tillage:** Contour tillage is the operation of tillage machinery on the contour, and it includes such operations as plowing, planting, listing, cultivating, etc. Contour tillage is only a part of contour farming.

**Strip Cropping:** Strip cropping is the growing of strips of densely growing crops between strips of clean-tilled crops planted along the contour. Whenever the strips of row crops are separated by approximately equal width strips of close-growing crops such as grass or hay, which are included in a rotation planned on the strip basis rather than on the field basis, the system is called contour strip cropping or rotation strip cropping (fig. 3). When the close-growing strips are much narrower than the cultivated strips and are not included in the rotation, the system is called buffer strip cropping. The strips of densely-growing crops may be of variable width to allow for the variabilities in slope so that the strips of row crops can be kept a uniform width.
Fig. 3. Contour strip cropping or rotation strip cropping are names given the system of contour planting wherein strips of row crops are separated by approximately equal-width strips of close-growing crops such as grass or hay.

Correction Areas, "Slack," Irregular Lands, "Duck Bills":
The terms correction area, irregular land, "slack" and "duck bill" are used to describe the irregular strips of land that lie between even-width contour strips wherever the slopes are irregular or variable. In fig. 4 the correction areas are represented by cross-hatching.

Irregular Buffer Strips and/or Correction Strips: When the narrower correction areas lying between larger even-width strips of intertilled crops are planted to close-growing, soil-conserving crops, they are called correction strips or buffer strips. The

Fig. 4. Irregular strips of land that lie between even-width contour strips are called correction areas, irregular lands, "slack" and "duck bills." They are caused by variations in degree of slope. They may be planted to point rows, to permanent or semi-permanent buffer strips, or in the case of contour strip cropping, to hay. In this latter case, even-width strips of row crops would lie between irregular strips of hay land.
irregular buffer strip resembles the hay strip in a rotation strip-cropping system in that it is designed to absorb the irregularities in length of slope resulting from variations in steepness of slope. However, it differs from the ordinary hay strip in that it is much narrower, being a good deal narrower than the adjoining strips of intertilled crops.

**Even-Width Buffer Strips:** Narrow buffer strips of even width with one edge on the contour are used in some sections where prevailing hot winds make it unwise to leave large gaps in the corn.

**STARTING A SIMPLE STRIP-CROPPING SYSTEM**

**PLANNING THE FIELD PATTERN**

The first step in laying out a strip-cropping system is planning a conservation program for the whole farm. Field boundaries may need to be changed to simplify contour farming and the proper use of each field. Shifting fences to fit the contour often makes possible the lengthening of level rows, thus cutting down on the amount of turning in farming operations. Land too steep to be farmed safely with terraces and contour farming should be used for pasture or wood lots. For the rest of the farm, the rotations will depend on the soil type, depth of top soil and the length and steepness of slope. The poorer and more eroded the soil and the steeper the slope, the more years of the rotation must be assigned to meadow crops.

**NUMBER AND WIDTH OF STRIPS**

Under average conditions strips of 84 to 126 feet wide are satisfactory. Twenty-four corn rows can be planted in an 84-foot strip. Narrow strips are more easily fitted to the land where the topography is irregular. Furthermore, unless the strips are narrow, in rough areas the rows farthest from the guide lines will soon get too far off the contour. Where the slope is gentle and uniform, strips wider than 126 feet can be used safely. In no case should the strip be so wide that the rows will leave the level by more than 3 feet in 100.

**LOCATION OF KEY CONTOUR LINE**

As guides for keeping the strips on the level a line should be staked out on the contour for every strip. The top key contour
Fig. 5. Locating the first key contour line (guide line) by moving up and down the slope until the horizon can just be sighted over the top of the ridge. If the top of the slope is gentle and the top of the ridge is broad, it may be necessary to lay the second key contour line above this point. All other guide lines will fall below this point.

line or guide line, as it is often called, should be located near enough to the top of the ridge that the sloping land between this line and the level ridge-top can be planted to contour rows which do not leave the level by more than 3 feet in 100.

The following procedure is being used successfully in the field. The man laying out the field goes to the steepest portion of the slope and runs a guide line through a point about 6 feet below the crest of the ridge. He will be standing approximately on this line when he is just able to sight the distant horizon over the crest of the hill (fig. 5).

In some cases where the top of the ridge is broad and the upper slope is gentle it may be necessary to put a second guide line above this point. This second line would be located by pacing up the slope from the first line a distance equal to the width of strip being used plus an extra 8 feet for the buffer strip. If we assume for the sake of illustration that the strips are to be 100 feet wide, the distance between the guide lines at this location, the steepest point on the slope, will be 108 feet (100-foot strip plus 8-foot buffer). The other guide lines would be laid out through points 108 feet apart measured downhill from the point used in establishing the first guide line (fig. 6).

In locating the top guide line many farmers use the following rule with good results: Place the top guide line about 8 feet vertically below the crest on average slopes (around 6 to 8 percent) about 4 feet below on gentler slopes, and about 10 feet be-
low on steeper slopes. This method is flexible and eliminates the need of an extra guide line above the first on gentle slopes.

On the soils that absorb water readily, level key contour or guide lines can be used. However, on soils that do not take up water rapidly, it is best to give the guide line a slight fall toward the nearest drainageway. Two to 4 inches per 100 feet is usually enough grade for the guide line to keep the rows from breaking over in heavy rains. To give the guide line a grade of more than 6 inches in 100 feet would be dangerous.

Moreover, extreme care must be taken to keep the grade of each row true to the guide line so that no sags or dips will occur where water will accumulate and run over. It is well to check the last row on the bottom of each intertilled strip to make sure it does not have a grade so steep as to cause scouring and cutting. If the last row is too steep, the strip must be reduced in width until the last row has a grade of 3 feet or less per 100 feet of length.

STARTING STRIPS OUT OF MEADOW LAND

The safest way to start strips is to plow them out of meadow land. If the ground is not already in sod, it is advisable to seed all the area in meadow and wait until the following year before plowing out contour strips for the row crops. This will provide well-soded meadow strips and waterways to hold and protect the soil.

The edges of the waterways should be kept irregular by staggering the edges of the corn rows rather than by planting them out to the same even edge (fig. 7). This is to prevent ditches starting from the dumping of water from all the corn rows

![Fig. 6. Postion of key contour lines. In this case it was necessary to lay an extra guide line above the first line because of the long, gentle upper slope.](image-url)
in one line up and down the hill. The waterways should be wider than any stream that will flow down them following the hardest rains. No waterway should be less than 1 rod wide. Narrow waterways will collect silt in the middle which will cause water to flow down the edges, where it will cut new ditches.

If the strips are plowed out of corn land that has been farmed up and down hill, the old dead furrows and back furrows will cause water to concentrate and start cutting gullies. If, under conditions of national emergency, it should become necessary in order to meet production needs to plant corn or soybeans on the contour on rolling land before first securing a meadow stand there, every precaution should be taken to work out all the old furrows wherever the land was previously tilled up and down hill. Some temporary protection should be provided by seeding some quick-growing crops in the waterways and buffer areas. Sudan grass, although slow starting, will make a good growth later in the season and will hold the soil fairly well. In the fall it would be necessary to drill a regular meadow mixture in the sudan. This will be difficult because the sudan does not leave the ground in good shape for a seedbed, but if the ground is plowed and worked into a seedbed, there will be danger of serious erosion from heavy fall rains. A regular meadow mixture with oats as a nurse crop could be seeded as early as possible in the spring, and the oats could be clipped later. In spite of all precautions there is always the danger of serious erosion in newly-planted waterways during hard rains.

Fig. 7. The right and wrong way of bringing corn rows out to the edges of a grass waterway. The corn rows should be staggered to prevent the cutting of a channel by the water dumped out of the corn rows.
Fig. 8. When the drainageways are steeper than the adjoining knolls, planting up from a guide line will cause rows to dip away from the waterways and planting down from a guide line will cause rows to drain toward the waterways. In planting up from key contour line B, the 24th corn row will be lower at point D on the ridge than at point F in the waterway. In planting down from key contour line B the 24th corn row will be lower at point G in the drainageway than at point E on the adjoining knoll or ridge.

PLOWING AND PLANTING FROM KEY CONTOUR LINES

If the drainageways are steeper than the knolls in between, as is the usual case, the crop rows should be laid out on the downhill side of the guide lines in order to make them drain toward the waterways. Where the drainageways are not as steep as the adjoining land, it will be necessary to plant up from the guide lines in order to dip the rows toward the drains. This latter situation seldom occurs except in such situations as where a spur ridge may drop off steeply on the lower slope or where the lower drainageways may have filled with silt from above until they have less slope than the land on either side.

In fig. 8, which represents conditions where the drainageways are steeper than the adjoining knolls, it can be seen how planting up from a guide line causes rows to dip away from the waterways so that they are likely to overtop during a heavy rain, and how planting down from a guide line causes rows to drain toward the waterways. The lines A, B and C represent contour lines marking 5-foot differences in elevation—row A being the highest, row C the lowest and row B being the line on which the key contour has been staked out. If 24, evenly-spaced crop rows are laid out above contour line B and 24 rows below, row 24 up and row 24 down will each be parallel to line...
B and equidistant from it. It will be noted, however, that row 24 up is closer to elevation A at point F (in the waterway) than at point D (on the ridge), which means that row 24 up is at a higher elevation at F than at D and so must dip toward the ridge. It will also be noted that row 24 down is closer to the bottom elevation C at G than at E and hence must dip toward point G which is in the waterway. If the drainage way had been less steep than the adjoining land, the conditions would have been reversed, the rows planted up from the contour would dip to the drain and the rows planted down would drain out on the shoulders. It is easy to see why under usual conditions (where waterways are the steepest parts of the slopes) crop rows should not be planted up from the guide lines.

If 100-foot strips are used as in the previous example, the whole strip can be plowed with a single back furrow or it can be plowed in two 50-foot lands, starting with a back furrow in the middle of one of the lands and ending with a dead furrow in the middle of the other land. Those who use this latter system claim it reduces the time required in turning at the end of the strip as compared with back furrowing the whole 100-foot strip. The positions of the back furrow and dead furrow are reversed with each new plowing. Since remnants of these furrows will last over from year to year, they can serve as guides for contouring.

Plowing in two lands will leave either a ridge or a furrow at the top of the strip and a depression in the dead furrow. Both ridges and furrows are desirable in contour farming so long as they remain on the contour or drain slightly toward the waterways.

End rows or turn rows are never plowed out. They are left in sod or permanent hay. Since water is often drained out of corn rows onto these turn rows, this part of the strip would erode badly if plowed, especially if it was plowed across the slope.

The irregular areas of extra land resulting from variations in slope will fall automatically into the buffer areas between the bottom of each plowed strip and the underlying key contour line. Because 8 feet were left for the buffer at the steepest point of
Fig. 9. Plowing an even distance down from each key contour line and leaving at least 8 feet of buffer land between the plowed strips at the steepest portion of the slope is an easy and effective way to lay out even-width strips between variable-width buffer strips. The buffer strips will absorb the irregularities caused by variations in slope.
the slope, the buffer will be at least that wide at all points. This system is illustrated in fig. 9.

The irregular area enclosed on the top of the ridge by the uppermost key contour line must be planted-out as conveniently as possible. If the top guide line is close enough to the top of the ridge, much of this area will usually be flat enough so that no serious erosion will occur. The usual procedure is to plant up from the top guide line a little way and then to fill out the crest which is usually flat or nearly so with long, straight rows and point rows, as is shown in fig. 10.

**USE OF CORRECTION AREAS**

The correction areas lying between even-width strips which have been laid out on the contour can be planted to meadow when a rotation system of strip cropping is used with meadow alternating with row crops. Furthermore, they can be planted to buffer strips or they can be planted to point rows. A very good practice is to leave the correction areas more or less permanently in sod and to farm the intervening even-width strips in

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**Fig. 10.** Judgment is required in filling out the ridge top of a contoured field. The main idea is to lay out the simplest pattern possible with the least turns and the fewest point rows. In this field the farmer planted up from the top key contour line for a few rows, then planted straight down the long flat ridge, filling in the few slack areas with point rows.
a rotation. Where, because of irregularities in topography, long points of gently-sloping land extend beyond the steeper areas of a slope, the buffer strips will become very wide in places, forming large "U"-shaped areas called "duck bills." Farmers who need lots of hay may prefer to leave these correction areas in meadow, but others, desirous of growing more row crops on these areas, which are usually not very steep and often include some of the best land on the farm, may plant most of such areas in point rows on the contour. In sections of the state where wind damage is increased by using wide strips of meadow between corn strips, the buffers are sometimes cut to a minimum. In some cases they are reduced to a uniform width no wider than will permit passage of hay-making equipment, and the rest of the land in the duck bills is planted to point rows (fig. 11).

Where buffer strips are not used, many farmers prefer to plant about two-thirds of the way down from a guide line and, then to plant up from the underlying guide line until all the full-length rows are planted. The resulting correction areas are then planted to point rows. By planting around the outside of a correction area and working in toward the center the amount of unnecessary traveling at the ends of the short rows can be reduced greatly. The planting pattern will be much like that shown in fig. 16.

**USE OF SOIL-CONSERVING ROTATIONS IN STRIP CROPPING**

On rolling land the number of years of rotation given to intertilled crops must be reduced and the years of hay and meadow increased. In general, the more erodible the land, the more it must have the protection of a close-growing crop. Some land can be held only by keeping it permanently in grass or trees.

Rotations may be planned on a field basis with every strip in the same field planted to the same crop in a single year with just a buffer strip between. Where this is done, it is customary to have a field for each year of the rotation. For example, if the general rotation best suited for the farm seems to be one of corn, oats, meadow, meadow, meadow, the land suited to cultivation on the farm will be divided into five approximately equal fields. The rotations may also be planned on a strip basis with different crops on various strips within the same field. Where
Fig. 11. Some farmers prefer even-width buffer strips. They plant the slack areas or duck bills to point rows.

This system is used it is convenient to use a number of strips which fit the years of the rotation or some multiple of that number. For example, a rotation of corn, oats, meadow can be fitted readily to three or six strips of approximately uniform area. Where the rotations are planned on the strip basis the practice is commonly called "rotation strip cropping." Where this type of planting is followed, there may be difficulty in pasturing the fields. The problem has been solved in sections of the state where a 4-year rotation is followed, by using a two-field system. Strips are laid out around the hills on the level as usual. A rotation of corn, oats, meadow, meadow is planned so that each year there will be alternating strips of corn and hay in one field and oats and hay in the other. In this way one field is available for pasture each year as soon as the small grain is harvested. Moreover, the two-field system avoids the planting of oat strips next to corn, which reduces the erosion hazard and the likelihood of chinch bug or grasshopper damage (figs. 12 and 13).

CONTOUR PLANTING WITH TERRACES

Terraces are valuable and in most cases indispensable to contour farming. They not only prevent losses of soil and water, but they also serve as permanent guides to contour cultivation. Many farmers favor straddling the terraces with strips in rotation strip-cropping systems (fig. 14). The chief advantage of this method is the protection afforded by the plant-
Field A

Corn

First year clover and timothy

Corn

First year clover and timothy

Field B

Small grain stubble, clover, and timothy

Second year clover and timothy meadow

Small grain stubble, clover, and timothy

Second year clover and timothy meadow

Gross waterway

Fence may be temporary

Buffer strip
Fig. 13 (opposite page). If a four year rotation of corn, small grain, meadow, meadow is used in a contour strip-cropping program, a two field system will make possible keeping one of the fields in alternating strips of small grain and legume meadow each year while the other field is in corn and meadow: Such a field can be pastured as soon as the small grain is removed.

Fig. 14 (opposite page). If a four year rotation of corn, small grain, meadow, meadow is used in a contour strip-cropping program, a two field system will make possible keeping one of the fields in alternating strips of small grain and legume meadow each year while the other field is in corn and meadow: Such a field can be pastured as soon as the small grain is removed.

Fig. 14. Contour farming goes well with terracing. Many farmers favor straddling the terraces with strips in rotation strip cropping.
Fig. 15. When rows are planted parallel to and down from the upper terrace, the point rows will fall in the channel of the lower terrace. This prevents the cutting of short rills between terraces by the discharge from point rows. When rows are planted up from the terraces, the point rows will fall below the terraces. Many farmers prefer this system because they find it easier to farm point rows below terraces than in terrace channels and because they do not like the silt bars that form in the channels when point rows are placed above the terraces.

Another publication on contour farming by the Iowa Agr. Exp. Sta. and the Iowa Agr. Ext. Serv., Contour Farming for Soil and Water Conservation, Bul. P11, contains the following subjects:
1. Effect of contouring on labor and fuel requirements.
2. Operating farm equipment over terraces.
3. Method of laying out the base (guide or key contour) line.
4. Construction and use of the walking A.

Fig. 16. Those who prefer to place the point rows in the middle of the strips can do so by planting both up and down from the terraces.