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Conserving Soil by Contour Farming

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Fig. 1.—A soybean field contoured with terraces. Rows are planted along the ridge of the terrace and parallel to that terrace turning on the short rows in the channel of the next terrace below. With a good crop rotation soil and moisture losses are cut to a minimum on this field. Photograph by courtesy of Soil Conservation Service, U. S. Department of Agriculture.

Contour farming is the operation of farm machinery across a sloping field, or around a hill, rather than up and down the slope. By this method of farming each crop row forms a small ridge across the slope, which aids in checking the flow of water, reduces the movement of soil, and increases the amount of water absorbed.

Contour farming may be practiced to advantage on either terraced or unterraced fields. It is an effective soil and water conservation measure on sloping fields, especially those with deep surface soils and permeable subsoils. Crop rotations, which include legumes and grasses, combined with contouring have proven effective in reducing erosion losses.

PLOWING WITH TERRACES

The effectiveness of terraces will be increased by doing all tillage operations across the slope and with, rather than across, the terrace. Maintenance costs will also be decreased and less power required to pull farm machinery on the contour rather than up and down the slope. All terraced fields should be plowed on the contour. The first year terraced land is cultivated, the terrace ridge should be back

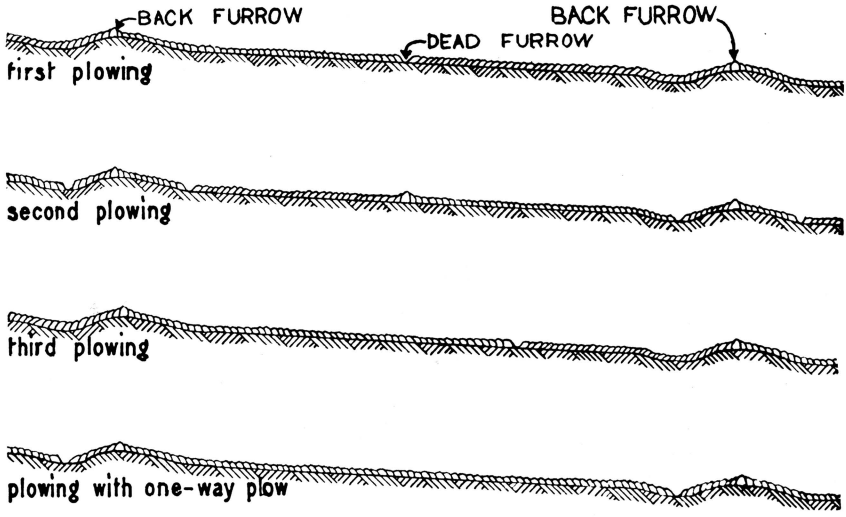

Fig. 2.—Methods of plowing terraces to maintain height and vary the location of the dead furrow.

furrowed and the area between terraces plowed out as a land, thus placing the dead furrow midway between them. The next time the field is plowed the land should be started at the dead furrow left by the previous plowing and plowed to the terrace channel. The terrace ridge is then back furrowed, thus placing the furrow in the terrace channel. As a result of plowing by this system, dead furrows are moved each time the ground is plowed, the height of the terrace is maintained, and the top of the terrace ridge can be kept well rounded. The last illustration in Fig. 2 shows how terraces may be plowed with a one-way plow. The terrace ridges are backfurrowed then the land between plowed out by turning all furrow slices up hill, leaving the dead furrow in the terrace channel. Furrow slices turned up hill catch additional moisture and the furrow left in the terrace channel together with the backfurrow on the ridge serves to keep the terrace well maintained.

PLANTING ROW CROPS WITH TERRACES

All row crops should be planted parallel to the terraces. Four methods are given:

(1) The rows may be planted on and parallel to the terrace above in which case, the point rows will end in the channel of the next terrace below (Fig. 3).

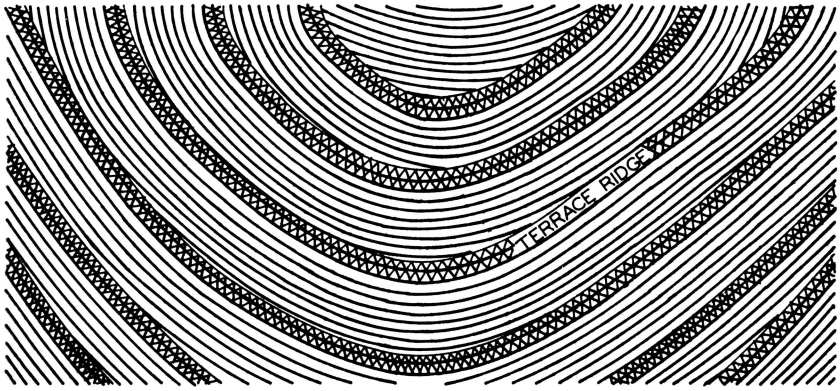

Fig. 3.—Planting rows parallel to the terrace ridge and turning on point rows in the channel of the terrace below.

(2) The rows may be planted on and parallel to each terrace, both above and below, with the point rows ending midway between terraces (Fig. 4).

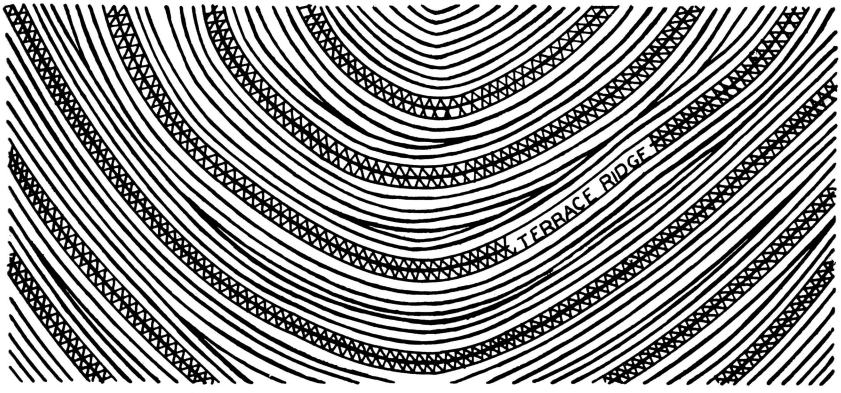

Fig. 4.—Planting rows parallel both above and below the terrace ridge with point rows midway between terraces.

(3) Another method of contouring with terraces sometimes used on gentle slopes is the selection of a key terrace with all of the rows,

both above and below this terrace, parallel to it. If only one key terrace is used, usually it should be at or near the center of the field. However, on fields not uniform in slope, this method allows the rows that are farthest from the key terrace to be planted far off the contour, which results in the terraces being crossed frequently at varying angles, causing the ridges to be lowered materially and placing an unnecessary strain on the machinery operated over them.

(4) Still another method is to use every other terrace as a key terrace and plant from it both ways until the terraces on either side are reached (Fig. 5). This method has about the same advantages

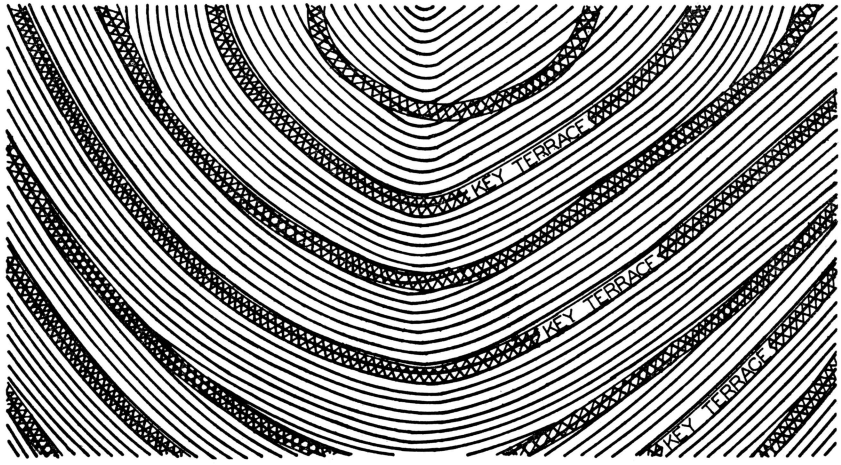

Fig. 5.—Planting from every other terrace as a key terrace.

and disadvantages as the system in which one key terrace is used. However, the rows will never be as far off the contour and the other terraces will not be crossed as frequently as with the single key terrace method.

Of the four methods of contouring mentioned, those with the rows most nearly on the contour save more soil and moisture. The experience of those who have used the different methods, indicate that the more exact methods are also more conveniently practiced than general contouring or key terrace methods. One of the chief reasons given for this is that it is not necessary to cross the terraces with crop rows. It is believed that the first method, in which the point rows run to the terrace channel, is superior to that in which they are used midway between terraces. With this method all turning, except that at the end of the field, is done in the terrace channel.

Each short row carries its individual runoff slowly to the terrace channel, thus reducing danger of the rows breaking during hard rains and causing large fans or shoals in the terrace channel. Ponding is also avoided during wet weather and trampling of crops is limited to the channel which usually will not yield well for a few years after terracing. Where the point rows are midway between the terraces as in the second method, water may drain from several short rows into the first through row, causing it and those between it and the terrace channel to break and form a small wash across the field to the first terrace below. The water flowing down this wash will carry sufficient soil to cause a shoal and partially obstruct the terrace channel. Main points of concentration caused by contouring will often need very narrow strips of grass between terraces.

On gentle slopes, (those not exceeding two per cent) corn or other row crops may be planted in straight rows, provided caution is exercised in crossing the terraces to prevent excessive lowering of the terrace ridges. In no case should terraces be farmed in this manner until they have become well settled, which usually is at least one year after construction. However, even on gentle slopes, less moisture is saved, more soil is moved, and more labor is required for maintenance of the terraces when the field is not contour cultivated. Rather frequent or timely inspections and repairs will be required to keep the terraces on such fields in good working order.

CONTOURING UNTERRACED LAND

It is desirable to combine contour farming with strip cropping on many fields, but contouring supplemented by grass waterways may be used successfully without strip cropping. On rolling fields of uniform slopes with a high organic matter content and permeable subsoil, erosion may be materially reduced by using a good rotation of crops planted and cultivated on the contour.

Before contouring an unterraced field, the following questions should always be considered: (1) Are there natural grass waterways well distributed over the field? (2) Is the subsoil sufficiently permeable to absorb water rapidly? Contouring on impervious soils may, in wet seasons, cause an occasional wet spot, particularly unless a careful system of grading toward the waterway is used. (3) Is the slope sufficiently uniform to make possible a slight fall to protected waterways without an excessive number of point rows? Fields with numerous knolls and depressions make contouring difficult because of the many points of concentration of runoff water. Vegetative protection must be provided at such points to prevent gullying. (4)

Are the existing draws and depressions well sodded or are they in close growing crops which may be used to carry the runoff water from the field with a minimum of erosion and gullying? With rains of high intensity and unusual duration a limited number of small washes will develop on fields contoured without terraces. However, much soil is saved because of the reduced sheet erosion.

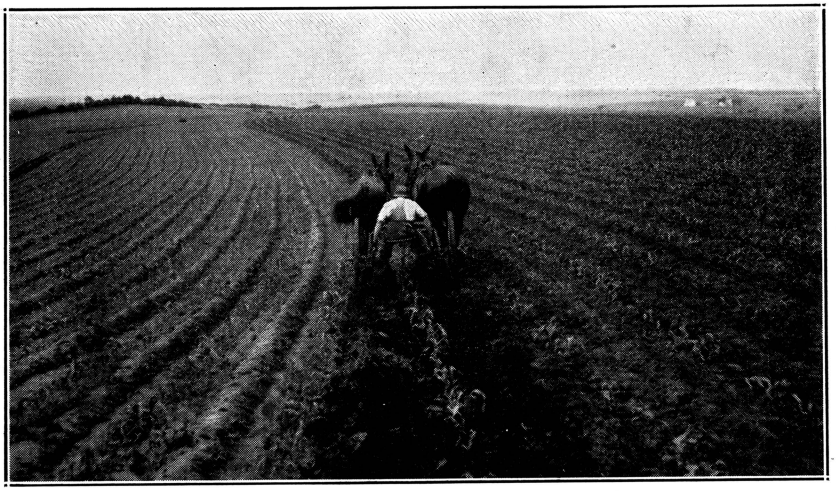

Fig. 6.—This is a rather general system of contouring used on a deep and porous soil typical of northwest Missouri. Runoff under these conditions is greatly reduced, yet in this field grassed waterways are too far apart and an occasional break-over may be expected. However, rows of corn are not washed out and a marked reduction in sheet erosion with an increase in moisture saved is the result. Photograph by courtesy of the Soil Conservation Service.

METHODS OF CONTOURING UNTERRACED LAND

In contour farming unterraced or unstripped land two methods are used; one in which the rows are approximately (very roughly) on the contour, and the other in which the rows are kept as nearly on the contour as practicable. Several variations of these methods are being used with varying degrees of success. Approximate contouring permits more concentration of runoff water with consequent gullying and larger losses of soil. Although this method has these disadvantages, it is easily done, reduces sheet erosion materially and protects seed and small plants in row crops from washing out and is to be preferred over farming straight up and down the slope.

Approximate contouring may be done by laying out a contour line midway on the slope and planting the rows across the slope parallel with this line. Contouring is much more effective if water

from fields above is intercepted by a diversion channel and carried to a protected outlet, such as a natural grass waterway or permanent pasture.

The more exact method of contouring is much more effective and requires considerable care in locating the base lines, so that the crop rows will be nearly level throughout the field, but gently graded toward the nearest waterway. Depending upon the slope, the grade in the row may increase from the base line until it is too steep, or decrease until the row is level or its grade reversed. A level or reversed grade will cause a break in the row during hard rains and result in added rivulets or small gullies. Such a condition more frequently occurs in contour and strip cropped fields where approximate contouring is used without correction lines.

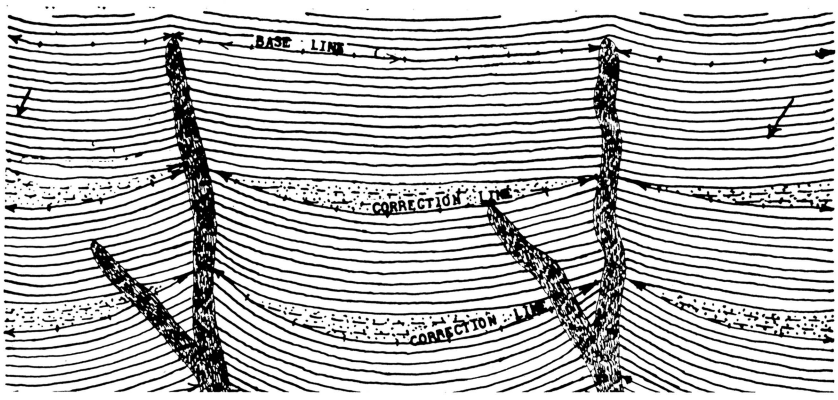

Fig. 7.—Correction lines and correction strips. The dotted area is the correction strip.

A correction line is a line surveyed to the desired grade and from which plantings are made to the next correction line. The distance between correction lines varies with the irregularity of the slope, the average slope, the grade given the adjacent correction line, the permitted deviation from the correction line, the practical limit in number of point rows, or the portion of the field used in correction strips and the type of machinery used on the field.

A correction strip is an irregular area used in the space between the correction line and the last through row above or below it. Frequently these strips are left in sod. Such sod strips are called correction buffer strips and are useful to turn on and assist in controlling runoff (Fig. 7).

A perfectly level row on a hillside is not safe for most Missouri soils, because of the danger of breaking over during hard rains and that of ponding on soils with impervious subsoils during wet seasons. For these reasons, it is considered advisable to give each base or correction line a varying grade of from 2 to 6 inches per 100 feet toward the natural waterway. With such a grade, the rows will carry water from a point near their centers to the waterways at either end. A correction line is advisable in the field when the grade in the row approaches or exceeds 2 per cent (2 feet vertical fall per 100 feet horizontal distance toward the waterway). This is because of excessive washing in the rows, particularly if the rows are long. When rows begin to grade away from the waterway toward the cultivated field, there is no doubt that a correction line is needed.

Procedure in Laying Out Unterraced Fields for Contour Farming.—A suggested procedure in laying out a field for contour farming without terraces (using correction lines to minimize breaking of rows and gullying, yet facilitating, drainage) is given.

(1) Leave sodded waterways well distributed over the field. If the field is already in cultivation without sodded waterways, use a fast growing annual, such as cane or sudan grass or such sod crops as timothy or red top. Where practicable, seed the natural drainageways early at a heavy rate to secure as much protection as possible.

(2) Adequately protect the field against sheet water from land above. Use interception channels if the field above can not be terraced.

(3) Run a level line across the field well up toward the high point to secure a rather definite idea as to the way the rows will lay across the field. The low point of the ridge may be chosen as the location for the level line. This will give an idea of the appearance of the first rows, which go completely across the field. Rows above this will curve around the ridge. Another level line above the first one may be run to give a more definite picture of the position these rows will take.

(4) Locate the high point in the field and come down the slope no farther than $\frac{1}{3}$ of a normal terrace spacing. (A normal terrace spacing will vary according to the slope. It is approximately 140 feet on a 1 per cent slope; 75 feet on a 6 per cent slope and 50 feet on slopes greater than 12 per cent.) The base line should be given a variable grade of from 2 to 6 inches toward the sides of the field or the natural waterway if one is present this high on the field. For example, with a row 500 feet long, draining in one direction, the grade may be 6 inches per 100 feet, for the first 100 feet from the waterway, then 5 inches per 100 feet for the second 100 feet; 4 inches for

the third 100 feet; 3 inches for the fourth 100 feet and 2 inches for the fifth 100 feet, the grade seldom exceeding 6 inches per 100 feet. A variable grade for longer or shorter rows may be surveyed in a similar way, by dividing the total length into equal parts and giving each part a definite grade. Short rows may have a constant grade.

If the water carried to the sides of the field by the rows will flow back on the field below, a dike should be constructed to divert it, or the rows graded to a point above a natural waterway and a strip of a close growing crop seeded from this point to the head of the natural waterway. If the rows above the first line are short and the soil deep and permeable, they may be kept almost level and the above precautions need not be taken for the small area. To prevent the top rows developing sharp turns when planted up from the first guide line rows may be started between the first guide line and the top of the slope. This will put the rows on the rough contour as shown in Fig. 3 and thus have point rows end against the first guide line the same as with other guide lines.

(5) Determine the steepness of the slopes on the land parallel, and immediately adjacent to the waterways and compare them with slopes out farther in the field between the waterways. If the slopes along the waterways are approximately the same or greater than any of the slopes between, plant the rows from the base line down until a correction line is needed.

To determine where the correction line is needed consult Table 1 which gives the width of strip that can be planted below the graded base line to stay within the allowable limit of 1½ or 2% slope in rows. Whether one chooses the 1½ or 2% slope in the rows depends on the length of the rows, (shorter rows can tolerate more slope) and the ability of the soil to absorb moisture rapidly. One may use a 100′ chain or tape (an ordinary smooth wire two or three hundred feet long may be used if needed) to mark off the last full length corn row above the correction line.

For example, if on a certain field you find the maximum difference in slopes along the waterway and out in the field to be 5%, consult Table 1 and you will notice that with rows approximately 800 feet long (400 feet draining in one direction), you may plant a strip of 40 rows (strip 140 feet wide) from the base line before exceeding a 2% slope in the row and 28 rows (strip 100 feet wide) before exceeding a 1½% slope. If one man holds the end of a tape or wire and walks on the surveyed base line while the other man holds the wire 140 feet from him and walks across the slope keeping directly down slope from the man on the base line, the location of the last row

Table 1.—Guide for Use of Contour Correction Lines.

To Be Used as a Guide in Laying Out a Rather Exact System of Contour Farming on Unterraced Land.

Maximum difference in percent slope of land paralleling and immediately adjacent to; and the slope between waterways.*

Suggested surface distance between correction lines or in other words, width of strip between correction lines that can be planted without point rows—given in feet and in greatest number of full length 42" rows.

Allowing 1½% slope in the row as maximum grade.

Length of rows draining in one direction. (Ft.)

	200		400		600		800	
	Ft. Width	† Rows	Ft. Width	† Rows	Ft. Width	† Rows	Ft. Width	† Rows
½%	518	148	1000	286	1465	418	1870	334
1%	259	74	500	142	732	208	935	266
2%	129	36	250	71+	366	104	468	132+
3%	86.1	24	167	46+	244	70	312	88
4%	64.6	18	125	34+	184	52	234	66
5%	51.8	14	100	28	146	40+	187	52+
6%	43.1	12	83.4	22+	122	34	156	44
7%	36.9	10	71.5	20	105	30	134	38
8%	32.3	8+	62.5	16+	91.7	26	117	32+
9%	28.8	8	55.6	14+	81.6	22	104	28+
10%	25.9	6+	50.0	14	73.3	20	93.5	26

Allowing 2% slope in rows as maximum grade.

Length of rows draining in one direction. (Ft.)

	200		400		600		800	
	Ft. Width	† Rows	Ft. Width	† Rows	Ft. Width	† Rows	Ft. Width	† Rows
½%	716	204	1400	400	2050	584	2670	762
1%	358	100	700	200	1025	292	1335	381
2%	179	50	350	100	513	146	668	190
3%	119	34	233	66	342	96+	445	126
4%	89.5	24+	175	50	257	72+	334	94+
5%	71.8	20	140	40	206	58	267	76
6%	59.8	16	117	32+	171	48	222	62+
7%	51.3	14	100	28	146	40+	191	54
8%	44.8	12	87.5	24	128	36	167	46+
9%	39.8	10+	77.8	22	114	32	148	42
10%	35.8	10	70.0	20	102.5	28+	133.5	38

*Plant *parallel and down* from correction line when slope is greater along waterway than between the waterways, and plant from correction line *up* when slope is greater out in the field between waterways than along side waterways.

†Width between correction lines in even number of full length 42" corn rows.

+Strips that only lack a small fraction of a row allowing two more full rows.

Rows 200, 400, 600 and 800 feet long draining in one direction were given 2½, 3, 3½ and 4 inches grade per 100' respectively toward the waterway.

which will have a grade not to exceed 2% may be determined. The lowest point on this line will be found along the waterway and may be chosen as the guide for the location of the second correction line.

To guard against errors in determining the true difference in slope of the land and continuous changes of slope as one moves up or down the hill, it is advisable to set up the level and check the grade in what is marked out to be the last full length corn row, before staking out another graded correction line. If it is found that some sections on this row have more than the grade desired for 200′ or more one should move back up the slope the width of two or four rows and check again. If the maximum slope in the row is found to be considerably below the allowed limit, one may move down the slope several rows width and check again to allow maximum width between correction lines. Establish the remaining correction lines in the same way. Some rather permanent methods of marking may be used to avoid the necessity of a new survey each year the field is put in to a row crop.

(8) Although rows are usually planted down from the correction lines, occasionally they may be planted up from the correction lines. This is advisable, however, only when the grade of the land between the hillside waterways is in excess of the grade on the edge of the waterways. This condition seldom occurs on the upper part of a slope, but is often found lower on a slope where a short spur ridge extends out and drops off over a steep point and is also often found down toward the bottom where the grade along the waterways begins flattening out. Under these conditions, in order to prevent water in the rows on either side draining to the steepest slope on the cultivated ground, the first row is planted on the correction line continuing from this row up the hill until another correction line is needed above as indicated in Table 1. Another method of planting such slopes is to give the correction line more grade toward the waterway than usual and plant below the line. However, this would make it necessary to have the correction lines much closer together and for this reason is most always undesirable.

DETAILED EXPLANATION OF CONTOURING METHODS

The following examples are described for those interested in the underlying principals and details of the better methods of contour farming.

There are two slope conditions which must be considered separately to secure a higher degree of success in contour farming. The condition found most frequently is that in which the slope im-

mediately adjacent to the waterway is steeper than the slope of the land farther from the waterway. The condition found less frequently is that in which the slope of the land immediately adjacent to the waterway is a more gentle slope than the land farther from the waterway. Both these conditions may occur in the same field or between the same two waterways. For this reason field slopes must be determined alongside and also between the waterways as each correction line is being laid out to determine the method of contouring required.

Contouring Slopes with Land Immediately Adjacent Waterways Steeper Than the Land Away from the Waterways.—This example includes a field with two grass or natural waterways 1000 feet apart. The slope of the waterway is about 7 per cent, and the minimum slope of the land between the waterways is about 5 per cent (Fig. 8).

I. *Laying out the base grade line.*—At approximately $\frac{1}{3}$ of a normal terrace spacing from the top of the slope, a base line is surveyed across the slope using a variable grade. The center is made the high point in the line and it is graded to the waterway on either side. The grade given is variable ranging from 2 to 6 inches per 100 feet. The first 100 feet from the high point is given 2 inches and the 100 feet next to the waterway is given 6 inches. Fig. 8 shows the total grade to be 20 inches or an elevation of 98 feet and 4 inches at points B and C, as compared to 100 feet elevation at point A. Rows are planted parallel and down from this graded line.

II. *Determining the location of the first correction line.*—The location of the first correction line can be determined by referring to Table 1 or by applying the following formula:

$$W = \frac{Di \times Le}{Mx - Mi}$$

W=Distance on field slope from one correction line to another which is same as width of strip between corrections that can be planted without point rows.

Di=Desired increase in grade of row over staked out grade of base line expressed in feet fall per 100 feet.

L=Length of last through row or last long row next to correction line expressed in units of 100′.

Mx=Maximum percent slope over which rows in question pass used as a decimal.

Mi=Minimum percent slope over which rows in question pass used as a decimal.

For example, if the correction line is placed on Figure 8 by use of the above formula (or by use of Table 1 which was calculated by use of this formula), and the desired grade in the row set at 1.5%,

the equation would be $Ds = \frac{1.17 \times 5}{.02} = 292.5.$ In setting up the equation Di would equal 1.5—.33 because the base line is laid out at an average grade of 4″/100′. The rows draining in one direction are 500 feet long, therefore 5 would be substituted for Le in the equation and the difference in slope between a 5% (the Mi slope) and 7% (the Mx slope) is 2%, which is used below the line as a decimal (.02).

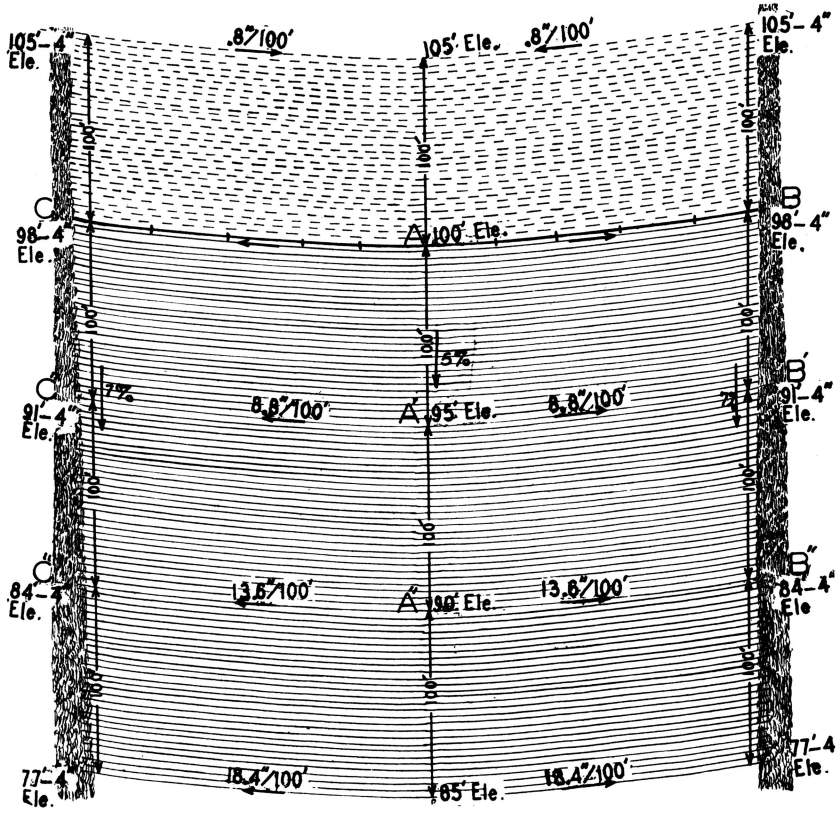

Fig. 8.—Solid lines show portion of field laid out for contouring. Dotted line shows portion laid out improperly. Grass waterways are shown on either side fo the field.

You will notice in Figure 8 that 300′ down the hillside the grade in the row is very slightly in excess of the 18″ or 1½% slope calculated for. Theoretically, at least a row planted 292.5 from the graded base line would have an even 18″ grade/100 ft. If near the lower edge of this strip of rows the grade should gradually change to a maximum slope along the waterways of 5% and a maximum slope between water-

ways of 7% (just the reverse in slope condition and amount) planting down from the one base line could continue until a strip twice normal width is planted without increasing the grade beyond 1½% or without reversing grade in the row. This would happen only at the change or reversing slope condition and would have application only at this location.

The above formula and calculations will be clarified by a thorough study of Fig. 8 and Fig. 9.

Contouring Slopes with Land Immediately Adjacent Waterways Less Steep Than Land Away from Waterways.—This example includes a rather steep field with two grass waterways approximately 600 feet apart. The slope of the land varies from a maximum of 15 per cent between the waterways to 10 per cent along the waterway (Fig. 9). The base line between the waterways is laid out by giving the first 200 feet from either waterway a grade of 3 inches per 100 feet and the remaining 100 feet to the high point in the center a grade of 2 inches.

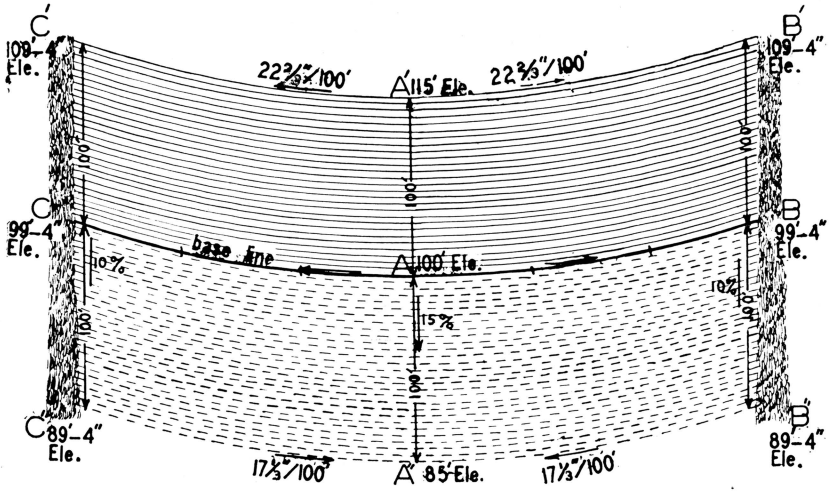

Fig. 9.—Note slope of land next to waterways is more gentle than midway between. Under these field conditions planting should be done above the base line.

A parallel line 100 feet below the base line shows a very different condition than that found in the first example. At the steepest point A″, the elevation is approximately 85 feet and along the waterway B″ and C″, the elevation is approximately 89 feet 4 inches as shown in Figure 9. The difference in elevation is 4 feet 4 inches with the

row grading away from the waterway at an average rate of 17⅓ inches per 100 feet. Water will concentrate at points other than the waterway, break over in hard rains and cause gullying.

A correction line would be needed every fourth row (approximately 14 feet) to prevent a reverse grade if planted in this way. If the base line is given a variable grade of 10 to 12 inches per 100 feet, a correction strip would be necessary to prevent a reverse grade only every 16 rows (approximately 56 feet).

The correct method for contour planting such a field is to plant up from the base grade line as shown in Figure 9. A line 100 feet above the base line will grade towards the waterway with an average of 22 and ⅔ inches per 100 feet. Since these rows are short, this grade could be permitted. However, an alternate plan might consist of a correction line placed through the highest point on a line only 70 feet (20 rows) up from the graded base line. This would still give a convenient spacing without an excessive grade in the last rows. In actual practice one may consult Table 1 for the recommended spacing of the next correction line. The only difference in application of Table 1 being that rows would be planted above instead of below the guide or correction line.

Contouring Small Grains.—On either terraced or unterraced sloping land, it is advisable to prepare the seed bed and drill small grains on the contour. Each drill row or wheel mark will serve to check the flow of water, and reduce soil washing until the small grain has rooted sufficiently to help hold the soil in place. Draws and depressions should be kept sodded.

Contour Furrows in Pastures.—Contour furrows are used to decrease the runoff and conserve moisture on pasture land and are not recommended for cultivated fields. They are much smaller than a terrace and spaced much close together (Fig. 10). Being small and similar to a large furrow or a tiny terrace, they are economically constructed. No more sod is destroyed in their construction than is necessary for development of maximum water storage capacity. The impounding principle on which they work differs somewhat from the principle of terracing. Because of the impounding principal involved observations indicate that furrows are more successfully used on permeable soils.

There are no accurately recorded experimental data to prove the value of contour furrows. Experiments are being set up to determine their value as moisture conserving structures. Observations made by the Extension Service in various parts of the state indicate that these structures do considerable good when used on medium to sparsely

sodded or closely grazed pastures. Farmers who have used contour furrows are enthusiastic and confident of their value.

Although a great variety of contour furrows are being experimented with, the type of furrow referred to below seems to come nearest to satisfying the requirements.

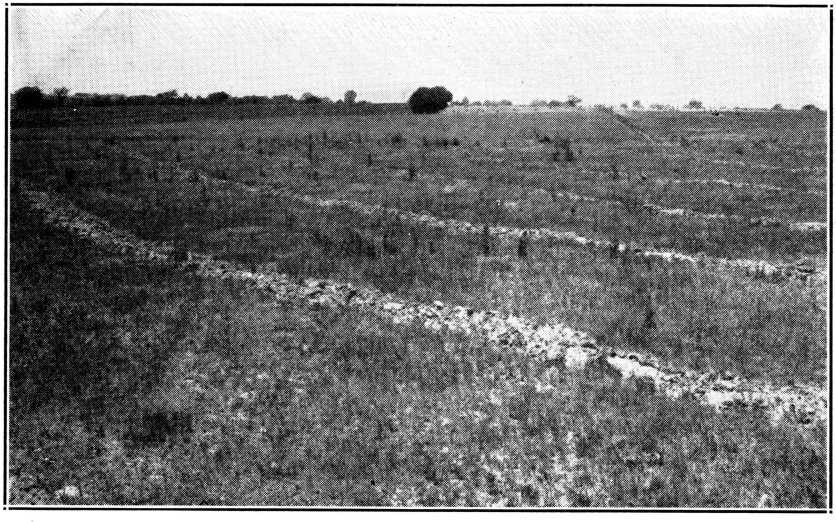

Fig. 10. —Contour furrows on pasture land. Photograph by courtesy of Soil Conservation Service, U. S. Department of Agriculture.

The furrows should be staked out on the exact contour using 25 or 50 foot stations. They should be spaced at from $\frac{1}{4}$ to $\frac{1}{3}$ the recommended terrace spacings or even less, depending on the degree of erosion, conditions of cover and permeability of subsoil. They may be made by simply plowing twice in the same place, throwing the soil down hill each time. This leaves a narrow, deep furrow with a steep ridge below it. Sod or a close growing crop established on the furrow ridges soon after construction adds to their safety. It also adds to the safety of the furrows if the channels are dammed at intervals of 100 feet or less to prevent breaks from draining the whole furrow.

Occasionally a furrow is given a very slight grade in which case an outlet is required, a variable grade is necessary and fills must be made and maintained. This destroys the water storage capacity and moisture is conserved only through delayed runoff. Furrows with a uniform grade frequently break near the outlet end.

Those interested in contour furrows should lay out and construct the system carefully and use them only on small areas until personal

experience is gained. The first furrows are made at the top of the slope as in terracing and water from any field above diverted from them. When, and if, the field is plowed for cultivation, the furrows are easily plowed out.

SUMMARY

1. Contour farming can be expected to increase crop yields materially on either terraced or unterraced land.

2. All terraced fields should be plowed and planted with the terraces to maintain properly and at the same time save additional soil and moisture.

3. On soils having moderate to tight subsoils all rows should be planted starting parallel to the terrace above and progressing down with parallel rows until point rows end in the channel of the terrace below.

4. Contour farming without terraces but with the use of correction strips, grassed waterways, and a maximum grade of 3% in the crop row for only a short distance can be expected to cut soil losses approximately 50% on the average cultivated field in Missouri.

5. Less effective control and less moisture conserved can be expected from an inaccurate system of contouring.

6. Contour farming is not expensive since it involves simply changing the direction of rows from up and down the slope to across the slope. Some additional time will be used in laying out the field and in planting it but a saving is reported in plowing and cultivating because the team or tractor is working on the level.

7. Sheet water from any field above should be cut off of the field to be contoured and grass waterways provided to drain water onto from the crop rows.

8. Suggested steps in laying out an unterraced field:

   Take note of present drainage system, such as draws and grassed waterways. If the field is in a sod crop pick some grassed depression or waterways and exercise care not to destroy the sod in them.

   Find high point of the field.

   Find average slope and determine what would be the terrace spacing.

   Find a point one-third terrace spacing down from the top of the hill.

   Lay off a level line each way from the center to the waterways or the edge of the field to determine the approximate length of rows.

From a point (or points) on this line mid-way between waterways or the edge of the field lay off a graded line toward the waterways. The line should be graded from this high point in the center toward the waterway on each side with a variable grade similiar to a terrace grade. ($\frac{1}{4}$ the length at upper end to have 2″ per 100′ the second $\frac{1}{4}$ to have 3″ per 100′, etc.) This is called a "guide line" or "base line." The next guide line needed is often called a "correction line."

Find the difference in the slope of the land below this line in feet fall per 100 feet both along the waterways and at the upper end of the graded row. (Slope reading to be taken at right angles or directly down slope from the graded row.)

Consult Table 1 to determine width of strip that can be planted before a correction line is needed. The very small area often found above the first guide line may be planted as shown in Fig. 3 on page 3.

Lay off the strip to the recommended width below the guide line by use of a tape or smooth wire.

Find the difference in feet fall per 100 feet along each waterway and between each pair of waterways, as before, for the next strip below. Lay off the next guide line starting one row's width from the lowest point on the line just marked off with the tape and then grade up to the high point in the guide line. The low point will be along the waterway. In cases where the lesser slope is found along the waterway the lowest point will be found somewhere between the waterways.

Lay off the strip to a uniform width as before.

When the slope of a field is found to be uniformly greater between waterways than along the waterway the first guide line can be placed at the bottom of the slope and the field marked off progressing up the hill with consecutive guide lines. However this condition of topography for the whole slope is rather unusual but is often encountered toward the bottom of the slope.

When such a condition is encountered the strip where slope conditions change may be almost twice the normal strip width because of the reversing slope condition. Operations can usually be speeded up at this point by estimating the proper width and then checking the line marking the lower edge of the strip.

Other systems may be worked out from detailed explanation given on previous pages.

9. Plow and drill small grain on the approximate contour.

10. Contour furrowing of pasture land is proving very effective in conserving and assisting in healing pasture gullies according to wide spread reports. Furrows should be made on the exact contour.

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