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TERRACING IN TEXAS

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TERRACING IN TEXAS

By M. R. BENTLEY, Extension Agricultural Engineer

The conservation of the soils of the rolling farm lands of Texas is one of our most important problems. Nearly all the cultivated land of Texas is subject to erosion. There are many ways in which erosion may damage the land. While gully washing is the most noticeable, doubtless sheet washing is the most damaging. Erosion may separate and carry the humus from the soil. Bottom land may be covered with sand. Natural drainage ditches in the bottoms may be filled, making artificial drainage necessary. Stands of young crops may be destroyed. Enormous amounts of commercial fertilizer are washed away. Terracing will reduce erosion and help to prevent these damaging effects of it.

Rainfall Conservation

The precipitation over west Texas is great enough nearly every year to produce good crops if all the rainfall were properly conserved. Frequently, however, the spring and summer rains fall very quickly and on unterraced fields run off without wetting the soil to any appreciable depth. It has been thoroughly demonstrated that terraces will check the runoff enough so that a fair crop can be produced, when on adjoining unterraced fields a complete failure results. In many instances where the slope is not too great the mere contouring of the crop rows will help very materially in holding the water on the land. This applies to the Plains country and similar lands. While contoured rows help a great deal it is advisable to use terrace ridges also.

The conservation of rainfall by terracing and contouring of rows would be worth millions of dollars to Texas annually. This should receive special attention in that part of Texas where moisture is the limiting factor in crop production.

Even in east and central Texas where the total annual rainfall is comparatively high, nearly every year the shortage of summer rains makes it well worth while to catch and hold these rains.

In west Texas, especially, it is well to consider the soil as an enormous reservoir in which to store the rainfall whenever it comes. It is really as important to store the rainfall in the soil for use several months later as it is to catch it on a growing crop.

In many instances, farmers in west Texas are not opening the terrace waterways into an outlet ditch, but are making the terraces big enough so that all the rainfall is held on the terraced field.

Instead of following the usual practice of diverting run-off water coming from outside sources, many farmers in west Texas permit this water to run in behind terrace ridges and thereby add to the water supply which comes as rainfall on the field. In fact, some farmers instead of diverting the run-off water from other areas away from their land, are diverting it onto their land.

Syrup Pan Terracing

A method of handling run-off water, that has been diverted into a field or a pasture, by making the water flow back and forth across the area by gravity flow, and which is being used more and more in west Texas, is called syrup pan terracing.

The foundation work for a syrup pan terracing job consists of building extra large terraces on the level on the field or pasture. The added feature that gives the job the name of syrup pan terracing consists of dirt works, or structures, that cause the water from one terrace to empty into the next terrace basin below and so on down the slope. Shallow basins are usually made above each terrace by turning the terrace ends up the slope a little ways. Whether the run-off water that is to be handled in a field is carried across the field above one terrace and back across the field above the next lower one and so on, or whether a portion of the water is turned into each terrace from a waterway running down the slope, will depend on the topography of the field to some extent. The commonly accepted meaning of syrup pan terracing is any system of handling the rainfall runoff on an area so that shallow lakes are formed on the slope, with each lake when filled emptying into the next lower basin, regardless of the particular system of spillways, spur terraces, and dams used to bring about the desired distribution of the water.

Pasture Terracing, Ridging, or Contour Furrowing

Just what device should be used in a pasture to check erosion or catch the rainfall will depend on conditions. If the pasture is an old field subject to gully erosion it is likely that a terracing job similar

to one that would be suitable in a field should be used. After grass has become established in such a case it may be that the terraces can be abandoned.

A case where terraces would be applicable in a native pasture would be where the water runs in small channels and it is desirable to spread the water which if unobstructed will follow channels while adjacent areas suffer by lack of sufficient water.

Terraces built in grass land may well be narrower than those in fields, as a matter of economy in construction costs and also so as to disturb less grass.

Wherever it is practicable to begin construction works such as terraces, ridges or furrows, at the upper reaches of a slope where the rainfall does not have an opportunity to concentrate in streams or gullies, it is advisable to use ridges or furrows instead of terraces. In general, contour furrows are preferable to ridges on open pasture that is comparatively free from rocks and brush. Ridges—small terraces 4 to 6 feet wide—are better adapted to brushy land than furrows, particularly as a matter of economy in construction.

It is suggested in building pasture ridges that the dirt be pushed from one side only, whether it is pushed uphill or downhill. The lines should be run level, and spaced about one-third to one-half as far

These pasture contour furrows, 7 feet apart, were made with a lister.

apart as on cultivated land. The close spacing is recommended because more of the pasture area may be flooded in that way without using large ridges. A small ridge made by moving the dirt from a trench about eight or ten inches deep and about two or three feet wide at the top, is suggested. If the terrace is made with a plow, it may be well to make one trip along it with a wooden "V" drag to pack the ridge.

Contoured furrows are made with a lister or a one bottom plow. A furrow spacing of about seven feet is suggested, although the furrows may be as close as three and one-half feet apart. If contour furrows alone are used, the guide lines may be surveyed just as if pasture ridges were to be built, and the furrows run as is illustrated in Figure 5 herein. In some cases, particularly on rather steep land, both the ridges and the furrows may be used to advantage on the same area.

As a matter of economy in construction it is suggested that no fills in gullies having steep banks be built but that the ridges or the furrows be turned uphill a little at the gullies to keep water from running into the gullies.

Cost of Terracing

The cost of terracing ranges from about one to eight or 10 dollars per acre depending largely on how steep the hillside is, and how badly it is gullied. The terracing of slightly sloping fields that are not gullied is the cheapest. On account of the proportionately high cost of damming the gullies in a badly washed field it will pay well to terrace a field before it begins to wash.

The average cost per acre for terracing as determined from a large number of fields is about $2.00 per acre, including gully fills.

The costs of contouring the rows on comparatively level fields for the purpose of conserving the rainfall is practically nothing, since the only extra work required is the surveying of guide rows.

Broad Base Terraces

Various kinds of terraces have been used in different sections of the country, but to avoid confusion only one type will be discussed here. The variations of this type of terrace necessary to adapt it to different soils and slopes will be considered.

The broad base terrace, as it is generally known, consists of a ridge from 16 to 24 feet wide at the base, built across, or around, the slope. The height of the ridge above the waterway along the upper

Ridges may be used in pastures where some brush and timber occur.

side of the terrace should be from 14 to 24 inches. We usually expect to be able to work over, and grow a crop on the broad base terrace.

Broad base terraces will permit modern implements to be used over them, and will usually grow the best crop in the field.

These ridges are placed at such intervals on the hillside that water starting down the slope by the steepest route will be checked before it begins to gather volume enough to wash. When the water comes to the terrace ridge it is carried along the waterway at such low velocity that it does not wash the soil, and so that much of the silt and vegetable matter in the water will be deposited. The terraces should have outlets at natural waterways or ditches so that during excessive rainfall the water may flow out the ends of the terraces rather than to break over the ridges. Exceptional cases where terraces are given no outlets are mentioned herein.

Narrow terraces, that is those from 4 to 8 feet wide, have the fault that they are rather difficult to cultivate even in row crops and with small implements. Also, they lack strength to stand heavy rains unless built quite high. The fact that some farmers have consistently used narrow terraces for many years and have kept the weeds off of them, and by their use have checked erosion, leads one to conclude that on some soils and under some conditions they are satisfactory when properly handled.

Preliminary Survey of Farm

The first thing that should be done in terracing a field is to consider its drainage with relation to surrounding fields. Often the absence of any definite plan for terracing the whole farm makes trouble as the work progresses. Sometimes the work first done must be changed.

The terrace outlets should be selected with the view to their handling the water from all the fields. Plans should be made to eliminate as many outlets as possible after the erosion has been brought under control. The water coming from surrounding unterraced land must be considered. If it can be diverted, this should be done by means of a levee, or a ditch. If there are not sufficient natural waterways across the farm to serve as outlets it may be necessary to cut ditches for the purpose. Outlet ditches should run along the fences if they will cause less inconvenience there than if run through the fields.

The changes that are likely to be made in the fields should be kept in mind. For instance, terraces are frequently emptied into woodland that may be later put into cultivation, or the same may be true of pasture land. The terraces and outlets should be planned so that the opening of new fields will not make necessary the changing of terraces already built.

The roads about the farm should be considered. Sometimes it is best to carry the water each way from such a road. Again it may be that a road-side ditch will form a good outlet ditch. It may be necessary to change the road so it will run on the top of a terrace. If some such arrangement cannot be made, a culvert may have to be put in, or the terrace built very strong where the field road crosses over it.

If the land to be terraced is stumpy, the stumps can be removed from the land to be occupied by the terrace, after the terrace line has been run.

Terraces usually cannot be run satisfactorily through an orchard. Orchard land should be terraced before the trees are set out. Each row of trees should be set on a terrace ridge.

Occasionally a field will have a rather high knoll or hill in the middle of it with no outlet ditch running high enough up the hill to form an emptying place for the terraces. If the hill is not too large, and the soil porous, it may be practicable to circle it with level terraces, located close together, until the top of the hill is taken care of, down to where an outlet may be obtained. Sometimes a terrace having some fall may be run once and a half or twice around the hill before it is emptied. Again it may be best to cut an outlet ditch up one side of the hill, to empty the terraces into.

Extreme care should be taken in selecting outlets in soil where the ditches wash and cave badly. In such soil the terraces should be emptied on grass land wherever possible.

The public roads have been used a great deal for terrace outlets and often the roads are damaged thereby. If there is danger of injury to the road, from the diverting of the water off the field to it, the outlet ditches should be run inside the field. Roadside borrow ditches are usually poor places to empty terraces, anyway, considering the tendency for such an outlet ditch to eat back up the terrace.

Land Preparation Before Terracing

The land is usually in the best shape for terracing after the crops have been gathered and before the breaking is started.

If the terraces are built before the land has been broken, spaces between terraces may then be taken as separate lands. The dead furrow will then run in the same general direction as the terraces and be a benefit in handling the water. It is extremely difficult to terrace after the field is listed. Lister furrows should never be run over terraces. The land between the terraces may be listed after the terraces are built.

If Johnson grass or Bermuda grass is to be eradicated from a field, it is best to do it before it is terraced, as terraces will interfere somewhat.

It seldom gets too dry to terrace, if the ground can be loosened at all, and as a rule it is better to terrace black lands and clay lands when they are dry.

If the gullies are to be plowed in or filled to make them easier to cross, it is best to do this after the terraces and dams are finished, otherwise a rain might carry out large quantities of the loose soil from the gullies.

Starting Point for First Terrace

There is usually some special feature in a field that will determine the place for running the first terrace line. It may be that some large gullies head at about the same elevation on the hill. Then the first terrace might be run so as to pass just above the gullies. If there is an orchard, a garden, a barnyard, or a rocky knoll that is to be avoided by the terrace lines, a line may be run just above or below such obstruction. Other terraces will then be spaced each way from this one. If it is desirable to have a terrace empty at a certain place the terrace may be

started there. It is not essential that the top terrace be surveyed first, but it should always be built first. Another important thing is to get the top terrace high enough up the hill. There should be no more vertical fall in the drainage area above the top terrace than there is between terraces. The top terrace is the important one, for the reason that if it breaks usually all the rest break.

Frequently after running the first terrace line it is advisable to go back and change the starting point and run the line again to get it at a more desirable place. This is especially true of fields having only a slight, but irregular slope. A little care in selecting the starting point and a few trial runs will often help in getting a neat job of terracing.

Instruments for Running Terrace Lines

The instrument used for running terrace lines need not be extremely accurate, but it is especially important that some kind of instrument be used on every terrace. A few terraces have been run by guess, or the "natural eye," but they are usually unsatisfactory. Again, some use an instrument and then do not follow the line run by it because it does not look right. Another mistake, that fortunately does not occur often, is to run one line with an instrument, and then to parallel the other terraces with this by means of measuring out an equal distance from it at intervals along it, making so-called "parallel terraces."

The point is that each and every terrace line should be run by some kind of fairly accurate instrument and then the lines followed pretty closely by the terraces.

The instrument most commonly used now is the telescope farm level. It is to be recommended because it is not extremely delicate, is easily adjusted and operated, and is not expensive. Its particular advantage over any home-made level is the greater speed and ease with which lines may be run with it.

Adjusting the Telescope Level

Since it is impossible to do satisfactory work with a level that is not in adjustment, the necessary adjustments for the telescope farm level will be described before its use is discussed. Everyone who uses a level should know how to test it and if necessary adjust it, for any instrument is likely to get out of adjustment while being carried about.

The adjustment of the bubble tube should be tested first. The object of this adjustment is to make the bubble tube perpendicular to

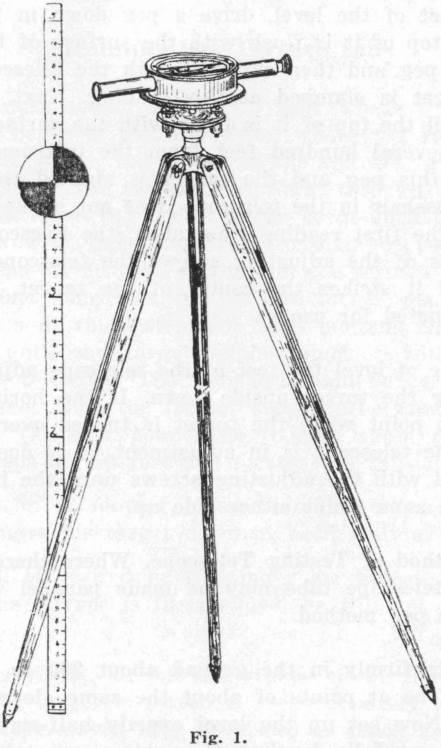


Fig. 1.
An inexpensive telescope level suitable for surveying terrace lines.

the vertical axis, or in other words, to adjust the bubble tube so that the bubble will remain at the center of the tube when the telescope is pointing in any direction.

First by means of the thumb screws make the instrument approximately level, then put the telescope over a pair of thumb screws and level exactly. Now turn the telescope half way around, or 180 degrees, on its vertical axis. If the bubble remains in the middle of the tube, no adjustment is necessary. Should the bubble change its position when turned 180 degrees, one end of the bubble tube must be raised or lowered by means of the adjusting screws, and then the test repeated. The test and adjustment should be repeated until the bubble remains in the center of the tube while the telescope is turned 180 degrees.

The second test is to see if the telescope tube is parallel with the bubble tube. This test may be made by the use of a pond of still water. The pond should be at least two or three hundred feet long.

Set up, and level up the instrument near the edge of the water. Then within a few feet of the level, drive a peg down in the edge of the water until the top of it is flush with the surface of the water. Place the rod on this peg and then sight through the telescope and set the target. The target is clamped at this reading. Next, another peg is driven down until the top of it is flush with the surface of the water, at some point several hundred feet from the instrument. The rod is then placed on this peg and the target is sighted through the telescope. If the crosshair in the telescope does not strike the target just as it did when the first reading was taken, the telescope must be adjusted. By means of the adjusting screws the telescope tube is raised or lowered until it strikes the center of the target. The instrument will then be adjusted for use.

On one make of level the test of the telescope adjustment may be made by turning the turret upside down. If the horizontal crosshair strikes the same point when the turret is turned over, as when it is right side up, the telescope is in adjustment. If it does not, the telescope is adjusted with the adjusting screws until the horizontal crosshair will hit the same point either side up.

Another method of Testing Telescope. Where there is not a pond convenient, the telescope tube may be made parallel with the bubble tube, by the two peg method.

Set two pegs firmly in the ground about 300 or 400 feet apart. The pegs should be at points of about the same elevation. Call these pegs A and B. Now set up the level exactly half-way between these two pegs. After carefully leveling the instrument, take a reading on the rod set on peg A. Then set the rod on peg B and take a reading. The difference in these readings will be the true difference in elevation of pegs A and B, even though the telescope tube is out of adjustment. Suppose the rod reading at A is 3 feet and the reading at B is 5 feet, then the peg A is 2 feet higher than peg B.

The instrument is next set up and leveled within a few feet of A or B. Suppose it is set up at A. The rod is set on peg A, and a reading taken. Suppose this reading is 4½ feet. Now we already know that B is 2 feet lower than A. Therefore when the rod is set on peg B, with the instrument still carefully leveled near peg A, the reading on the rod should be 4½ feet plus 2 feet, or 6½ feet.

If the horizontal crosshair does not coincide with the target when it is placed at 6½ feet, the level is out of adjustment. The target is clamped on the rod at 6½ feet, and the telescope tube is adjusted up or down, as the case may be, until the horizontal crosshair cuts the middle of the target.

The instrument should then be in adjustment and ready for use.

Running the Terrace Line

The instrument should be set up near where the terrace line is run, the object being to get a position where the rodman will be in view, and to get within the range of the rod. The rodman holds the rod at some point on the terrace line. Sight through the telescope and have the rodman move the target up or down until the center of the target coincides with the horizontal crosshair in the telescope. The rodman now steps off 50 feet, and to run the terrace down hill, moves the target up one inch, if a fall of two inches per hundred feet is desired. The man at the instrument then motions the rodman up or down the hill until the target again coincides with the horizontal crosshair of the telescope. The rodman should be careful to keep his distance of 50 feet from the former stake as he moves about finding the location for the next point. The rodman again moves his target one inch and steps off 50 feet and locates the third point, and so on.

If the rodman is moving away from the terrace outlet, or up grade, he will move his target down at each station.

If more fall is desired he will move his target farther for each 50 feet, or if the terrace is to run level he will not move the target at all.

It may be advisable to put the stakes closer than 50 feet apart, in which case the target is moved a proportionately less distance. On smooth hillsides the stakes may be placed as much as 100 feet apart.

After the rodman locates the line for several hundred feet from the instrument, it will be necessary to move the instrument up closer. Sights over 250 yards long should be avoided as they are not accurate. In moving the instrument the rodman remains at his last location until the instrument man has again set up and taken another sight on the rod at this station. The target is brought into line with the telescope crosshair by moving it on the rod while remaining at the stake. After getting the target set for his new position of the instrument, the rodman moves his target a certain number of inches and locates new points on the terrace line as before.

The terraces are usually spaced according to the vertical drop between them. To locate the second terrace a certain number of feet below the first, a reading is taken with the rod on the first terrace, then the desired drop is added to this reading and the target moved up accordingly. The rodman then goes down the hill from this point in the direction of the steepest slope and locates a point where the target coincides with the horizontal crosshair. This gives a starting point for the second terrace.

Length of Terrace

Short terraces are easier maintained than long ones and it is therefore best to keep the terraces as short as is practicable without making the outlet ditches too numerous. It is best to keep the terrace length, over which the water is carried in one direction, under 1200 feet. If the water is carried each way from the middle of the terrace this would make a length of 2400 feet. Sometimes it is advisable on a large smooth field to carry the water much farther than this to reach a suitable outlet. Terraces may be made longer safely when the slope of the hillside is not great, and where the terraces are not too crooked, or the field badly gullied. Terraces have been built to carry the water satisfactorily as much as 3000 feet.

Fall Along Terraces

The proper fall to give along the terrace will depend on the ability of the soil to absorb the water, and on the slope of the hillside. Sandy soils except those underlaid with a tight subsoil should have less fall than the black lands or clay lands with the same slope. Short terraces or medium length terraces on open sandy soils may run level. Four inches per 100 feet should be the maximum on any soil. When in doubt about the proper fall, 2 inches per 100 feet will not be far wrong. The "terracing table" will give some suggestions on this point.

Sometimes it is desirable with a long terrace to use a variable fall. The use of a variable fall will sometimes assist in running a terrace in a more desirable location. In using a variable fall the outlet end of the terrace should always have more fall than the upper end. A terrace with a variable fall might have a few hundred feet at its upper end run level, then a section with a fall of 1 inch per 100 feet, then a section with 2 inches fall per 100 feet, and so on, with 4 inches per 100 feet the maximum.

Level Terraces

In west Texas where rainfall conservation is most desirable the terraces should be run level. With level terraces there should be less water carried from the field, and consequently, a greater quantity taken up by the soil.

On the Spur Station, land terraced with level terraces has consistently produced more per acre than land terraced with terraces having 3 inches fall per 100 feet.

Marking Terrace Line With Plow

When establishing a terrace line it is always best to set stakes or other markers as the points in the line are located by the rodman. Before these stakes are knocked down or lost, the line should be run out with a plow.

The line of stakes will frequently form a very crooked or jagged line. These short, sharp bends should not be made by the line run with the plow.

On land with a medium slope the plow may miss some of the stakes by several feet. Rather than to have sharp bends in the terrace, it is better to smooth them out and make a little extra fill in the terrace embankment. These sharp bends can best be worked out if the person driving the plow, or the one walking ahead of the team or tractor can see several stakes ahead as he moves along.

Running Terrace Line Across Gullies

The rodman in locating points in the terrace line should avoid setting the rod in gullies, or on high ridges or knolls. In running a line across a badly gullied field, unless the gullies are very broad, it is good practice to set one or more stakes on each ridge between gullies, and no stakes in or near the gullies. When this is done it is intended that the terrace ridge will be built straight across the gullies and that the necessary dams will be built in the gullies. Where the gully or depression is broad—50 feet or more—it is usually undesirable to run the terrace ridge straight across it. In this case the terrace is usually curved up into the draw so that the fill will not need to be so great. If the land owner is willing to make the heavy fill the terrace might run straight across the broad gully or depression.

Spacing of Terraces

Terraces should not be spaced too far apart, and yet there is no rule for the exact distance they should be. Suggestions are given in the "terracing table." If the terraces are too far apart there will be washing between them, and there will also be danger of their breaking from having too much watershed. If the terraces are too close

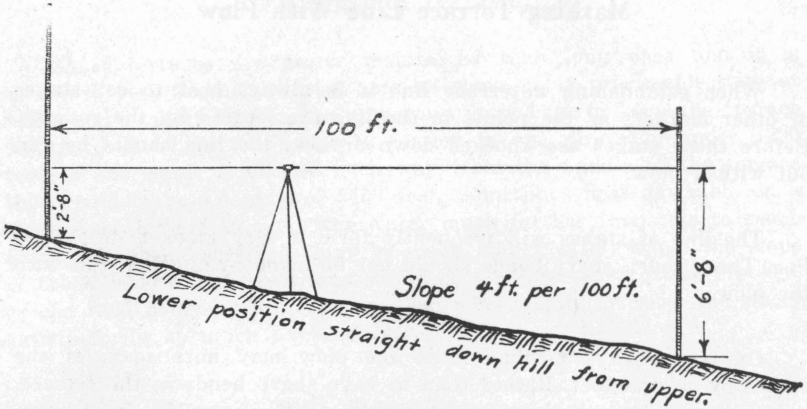


Fig. 2.

This is how slope of land is measured to obtain a value to use in top line of figures in the "Terracing Table." The slope is measured straight up and down hill, and if the hillside slope varies throughout the length of the terrace, it should be taken where it will be an average.

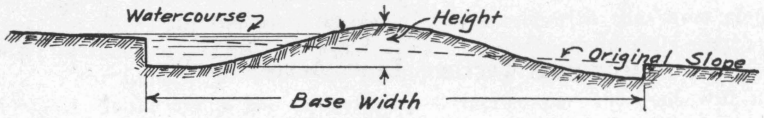


Fig. 3.

Cross section of a terrace before banks are plowed in, to show how dimensions are taken.

Terracing Table

The terracing table gives suggested size, fall, spacing, etc., for terraces according to slope of land.

Slope of land in feet per 100 feet	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Vertical fall between terraces in feet	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7
Distance between terraces in ft.	150	100	83	75	70	67	64	62	61	60	59	58
Fall per 100 feet along terrace in inches	0—2	0—3	0—3	0—4	0—4	1—4	1—4	2—4	2—4	2—4	2—4	2—4
Base width of terrace 1st year in feet	22	22	20	20	20	20	20	18	18	18	16	16
Height of ridge while dirt is loose in inches	16	18	18	18	20	20	20	22	22	22	24	24
Linear feet of terrace per acre	290	436	525	581	622	650	681	703	714	726	738	751
Acres terraced per day with 6 mules on V-drag and 2 mules on plow	8–12	5—8	4—6	3—5	3—5	3—4	3—4	3—4	2—4	2—3	2—3	2—3

NOTE.—The use of the above "Table" will be simplified by referring to Figure 2 which shows how to measure the slope of land to apply in the first line of figures in "Table."

Reference to Figure 3 may also help in using the "Table."

together it makes the terracing more expensive per acre than necessary. On a large per cent of the hilly lands of Texas needing terracing, the proper spacing will be from 3 to 4 feet vertical drop, which should make the terraces from 100 to 80 feet apart. The steeper the hill and the easier the soil washes the closer the terraces should be. The spacing may be quite different in the same field on account of the variations in the slope. In using the "table" for finding suggested spacing, the average slope of the land throughout the length of the terrace should be used as a basis.

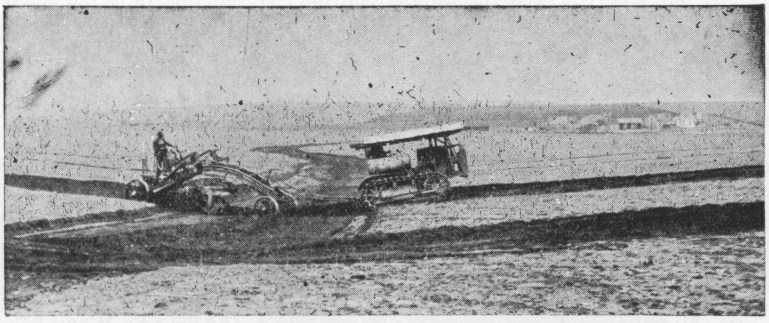
A rule for spacing terraces that is easily remembered is as follows:

Measure the average slope of the land in feet per 100 feet. Add 2 feet to this slope. Take one-half of this sum, or less, as the drop between terraces.

In placing terraces on slightly sloping land for conserving rainfall only, they may be spaced 200 to 300 feet apart if desired, although closer spacing would give a better distribution of the water. On land with an average slope of less than 1 foot per 100 feet it is well to select a vertical spacing that will make the average horizontal distance between terraces about 200 feet.

Building the Terraces

Although any of the terrace lines may be laid off first, it is important that the top terrace be built first. Each terrace should be completed before work is started on the next terrace below. If this is not done rain may come and carry away one of the lower terraces because it is not protected by completed terraces above it.



This county owned outfit building a terrace is shown crossing a gully.

Terraces are built with various implements. Sometimes they are built with a plow alone by simply backfurrowing a land several times. Frequently a wooden "V" drag is used with a plow. Other implements used are steel ditchers, terracers, road graders, and fresnos, or slip scrapers.

In using the plow and "V" drag, a strip about 6 feet wide is plowed first, throwing the furrows together. Then each furrow as it is turned by the plow is pushed up with the "V" drag. After a strip about 20 feet wide has been plowed and pushed up, the plow is started again near the center of the ridge and the plowing and the dragging are repeated until the terrace has the proper size. Sometimes the strip in the center, of 4 or 5 feet width, is not plowed but left solid. The first round with the plow is made around this narrow strip, and the "V" drag follows the plow from the start.

If the hillside is rather steep it is best to use the "V" drag mostly on the upper side of the terrace pushing the dirt down hill. This is easily done if the "V" drag is made reversible. The steel ditcher or terracer is used very much in the same way as the "V" drag. Sometimes it works best when not preceded by the plow, but allowing it to cut its own way. Most steel ditchers and terracers are made reversable so that they may be used entirely on the upper side of the terrace if desired.

Terraces are sometimes built almost entirely with a fresno. In using the fresno a strip of land about 30 feet wide is first backfurrowed with a plow. The dirt at the outer edges of this strip is then picked up with the fresno and dumped in the center of the strip.

Experience in building terraces will help in getting the most out of the implement and power used. For instance, the proper place to stand on a "V" drag, or steel ditcher, so as to get the dirt moved fastest with the least power, is learned by experience. It should be remembered that terrace building requires the moving of a considerable amount of dirt which requires power and time, and one should not expect to get a terrace built in 4 or 5 rounds with any implement, except the large road graders.

One should be sure that the top terraces are well built, for not only does the safety of the lower terraces depend on them but the first few terraces at the top of the hill really stop a large per cent of the erosion of the entire hillside. If only a limited amount of time can be spent terracing, it will be much better to build the two top terraces well than to half build four terraces.

Suggestions on building a terrace with a large crawler type tractor and a grader are given in Extension Service Circular MS-256.

The "V" Drag

The "V" drag has been used a great deal for terrace building. It is not expensive and is easily made. The wings should be made of 2" x 12" hard pine lumber with one side planed.

The spread of the wings should not be too great or the dirt will not slip along the pushing wing. A little more spread may be given for sandy land than for clay land.

The outside edges of the wings should be shod with light strips of steel, such as old buggy tires.

It is well to make each side of this drag alike so that it may be used with either side up. This is necessary if it is to be used on the upper side of the terrace only.

The dimensions of a "V" drag for a four horse team should be about as follows: Length of short wing, 6½ feet; length of long wing, 9½ feet; spread of wings about one-half of the length of the short wing.

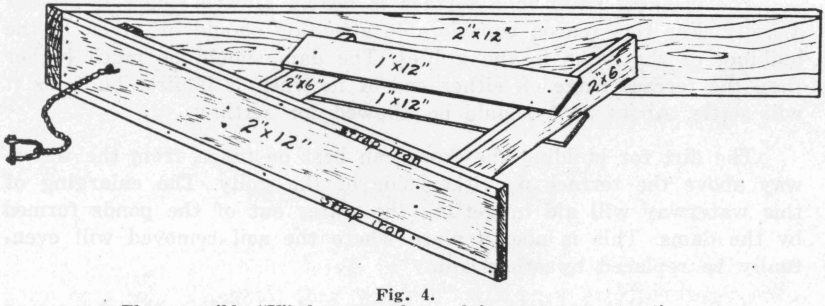


Fig. 4.
The reversible "V" drag may be used in terrace construction.

Size of Terrace

Terraces should be built broad so they will have strength to hold flood waters, and also so they may be cultivated easily. The height should be great enough that they will not be overtopped by dashing rains. A terrace with a base width of 20 feet and with the top of the ridge 18 inches higher than the waterway is considered a good terrace. To get such a terrace requires the moving of considerable amount of dirt, but it will give better satisfaction than a small terrace and will be cheaper in the end.

On very steep slopes it is sometimes not economical to build terraces 20 feet wide, but they should have plenty of height and should be broad enough to permit the planting of a crop on them.

A terrace with a base width of 5 to 8 feet may be used on grass land that is used for grazing only. The principal advantage of the narrow terrace is that it is cheaper to construct.

Any terrace should have a broad flat waterway when first built. This is easiest obtained by moving the dirt mostly down hill from the upper side of the terrace.

It is good practice to use the terracer or grader on a little narrower strip of land than is desired for the width of the terrace. The final width of the terrace may then be obtained by backfurrowing with a plow from the central part of the ridge out to the desired width.

One of the best methods of rounding off terrace ridges so that a combine will go over them easily is to backfurrow them a few times with some kind of a plow to a 35 or 40 foot width always throwing the dirt toward the ridge.

Damming the Gullies

The weakest point in a terrace is nearly always where it crosses a gully. For this reason considerable attention should be given to the building of the dams in the gullies. The dam should be much higher than the terrace ridge on either end of it, when it is first built, as it will settle. About 25% should be allowed for settling.

The dirt for building the dams can best be taken from the waterway above the terrace on either side of the gully. The enlarging of this waterway will aid in getting the water out of the ponds formed by the dams. This is also a place where the soil removed will eventually be replaced by other soil.

A fresno is better than a slip scraper for building these dams as it will move the dirt faster and is easier on the man handling it.

Gullies must be filled where crossed by terraces.

Terrace Outlets

Terraces frequently fail because they are not properly opened into the outlet ditch. If the terrace is to be emptied through a fence into a ditch outside the field, it is not sufficient to spade a narrow trench from the terrace waterway to the ditch. This outlet should be from 6 to 8 feet wide. It need not be deep and as a rule should be no deeper than the terrace waterway. A broad, shallow outlet instead of a narrow one will frequently prevent a ditch from eating back into the field. Should this outlet begin to wash a ditch back into the field, sometimes a few scrapers of dirt properly placed in the outlet will stop the trouble. However, in some soils, especially some of the black land soils, this eating back of the terrace outlet is not so easily controlled.

The fact that a terrace outlet caves back and forms a ditch does not always indicate that the terrace has too much fall over the last few hundred feet of its length. Such washing back from a ditch may occur in certain soils even though the terrace is run level.

If serious erosion in terrace outlets is to be expected on account of the soil type, it will be well to empty terraces on a permanent pasture, and if such is not conveniently located, a permanently grassed strip down the slope to be used as an outlet for the terrace may be prepared.

Maintenance of Terraces

If terraces are built large in the beginning, their maintenance is an easy job. About all they will need will be a backfurrowing once a year, and possibly the removal of a few sandbars or silt bars from the waterway with a scraper or fresno.

It is very important that attention be given to the terraces, while they are new, after or during heavy rains. A man with a shovel can often patch a few breaks very easily if the work is done as soon as it is needed. Often a little work at the right time will save serious washing and gullying.

In flat breaking a terraced field it is well to take a plow land between the terraces. By starting the lands on top of the terraces they will be raised slightly each plowing, and there will also be a dead furrow formed halfway between the terraces, which will aid in checking the water.

Some difficulty is experienced in keeping up terraces in blow sand. They should be built high, even though they are not so broad, and then sowed in some crop that will catch the sand on the terrace, thereby building it higher. Any small grain, or grass that will grow well and not be a pest, may be used.

There is some trouble with dry weather cracks, and with gophers, making leaks through terrace ridges, which if not located and stopped at once will make bad breaks. The cultivation of the terraces will help prevent the cracks from making trouble, and the killing out of the gophers will prevent further trouble from that source.

This terrace ridge is maintained by backfurrowing with a plow.

Cultivation of Terraced Fields

Many use the excuse for not terracing, that terracing makes the cultivation of the field so difficult. In some cases it makes the cultivation a little more tedious, but it is work that pays well.

Terraces with the crop rows laid off with each terrace do not prevent the use of implements of the two, three, or four row type. Thousands of acres of terraced land with contoured crop rows are being farmed with implements that handle more than one row at a time.

Properly built terraces do not cause any serious difficulties in handling sowed crops. Big implements, including combines, are used in terraced fields.

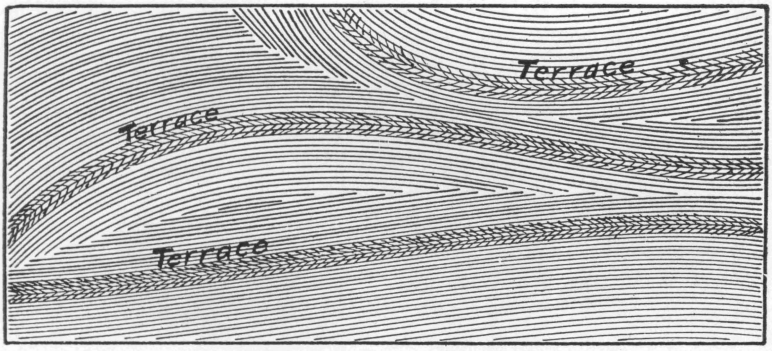


Fig. 5.
The way to run crop rows in a terraced field.

If the field has an excessive slope it may be advisable to terrace it and then sow some kind of grass and use it for grazing only. Sometimes it is best to sow the terrace ridges in some annual grass or sorghum, and then plant any other desired crop between them, especially on blow sand.

The best way to run the crop rows for conserving the soil and moisture and for protecting the terrace ridges, is parallel with the terraces. To run the rows parallel with the terraces, a row should be placed down the middle of the terrace ridge. On each side of this row other rows are planted at regular intervals until they reach points about midway to the next terrace. Then a row is planted on top of the next terrace and rows run parallel with it until they meet with the rows which parallel the other terrace. This may leave some places where short rows must be put in to cover all the territory between the terraces. These point rows are what many farmers try to avoid. If attention is given to placing the point rows in pairs as much as possible, some extra driving may be saved in cultivating.

Sometimes the rows are started on top of a terrace and run one after another to the next terrace, where a new guide row is laid off on this terrace. This method will make the point rows at the terrace, which is not desirable. It is better to have them midway between the terraces.

The crop rows should not run up and down the slope whether the field is terraced or unterraced.

There are several means of assisting terraces in controlling erosion. Deep plowing will help the land absorb some of the water that would run over the surface. The addition of humus or vege-

table matter to the soil will cause it to absorb moisture more rapidly. Cover crops will check the water and hold the soil.

Terracing should be considered as the important factor in checking erosion, and as the first step toward rebuilding, or retaining, a fertile soil on the sloping lands of Texas, as well as of greatest importance in conserving the rainfall.

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