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Put Hilly Land To Work

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**Put HILLY LAND TO WORK**

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**WHAT TO DO with the land** that is so hilly and steep that it cannot be farmed in the usual way is a problem on many Iowa farms. We have been trying to get an answer to this problem in a joint research project of the Iowa Agricultural Experiment Station and Soil Conservation Service of the USDA.

For studying the problem the government dropped into our laps a 187-acre farm in southern Iowa at Floris. The farm had been so badly eroded that all of the topsoil was gone over most of it and even some of the subsoil had been washed away from parts of it. In Iowa we have a lot of fertile, nearly level or rolling land that good farming practices will keep producing cultivated crops well. But on many farms there are areas so steep that they cannot be farmed in the usual manner.

This farm on which we started working in 1937 was poor enough that it had been unable to support a family, so that it had been sold to the government at $10 an acre.

In the 8 years that we have been working on this problem, we feel that we have made some progress. We have demonstrated that soil of this kind—very hilly and with most of the topsoil gone—will produce certain crops successfully. We have found that it will produce grapes, plums, nut trees, post trees, farm forage trees (such as honey locust with high sugar content, bur oak and selected persimmons), high tannin sumac, figured walnut and other trees for veneering, conifers for Christmas trees and trees of various kinds for shelter belts, woodlots and even for lumber production.

**Fruit Yields**

Here are the yields we have obtained on this extremely hilly, badly eroded soil: Grapes up to 8 pounds per vine, or about 2 tons to the acre; plum yields as high as 5 to 6 bushels to the tree and an average of 3½ bushel per tree from 5-year-old trees (Superior variety) in 1942. These best yields of grapes and plums have been obtained by using the best horticultural practices such as spraying and the best adapted varieties found, but without the use of any kind of fertilizer on the soil. The crop from one plum tree in one season has sold for enough to pay for the land at the price it was purchased—$10 an acre.

The crops listed above are not the usual kind of crops we think of producing on Iowa farms, but neither are these steep areas the usual kind of farm land. We must find crops that fit this kind of soil to get the most from it.

**Forest or Pasture Land?**

In the past the answer to the problem of how to use our soils of different degrees of slope has seemed simple—rotation cropping for level to moderately hilly land—pasture and forest for steep, hilly land. Recently we have learned that because livestock injure trees, it cannot be pasture and forest for hilly land, but we must decide whether it should be pasture or forest.

There really is no set rule for deciding how to use steep land, but we do know that we must keep this soil "nailed down" with roots of grasses and legumes or with trees and woody plants.

**Pasture and Woody Plants**

In our experiments at the Cooperative Hillculture Farm at Floris, we have shown that you can grow grasses and legumes such as are usually used for pasture or meadow in strips between contour rows of fruit trees or other kinds of trees, vines or shrubs. These strips of grass and legume crops hold the soil in place, build it up and prevent water runoff.

This means that we can produce fruit and other valuable crops on soils where erosion control would be impossible with our usual Iowa cultivated crops. This permits us to use grasses and legumes along with woody plants (trees and vines) to conserve soil and water to the advantage of both kinds of plants and at the same time produce valuable fruit crops or other woody plant crops.

We do not pasture these strips.
in between the trees. They are established and grown to help conserve soil and water. In this way we obtain the beneficial soil conserving effects of pasture, meadow and woody plants growing in the same sort of plant communities as they do in nature around the edges of woods. If you like a bit of hunting occasionally, you may be interested to know that these provide fine wildlife areas.

**Fruit on the Hills**

One of the best uses that can be made of some of these steep hills is to put them into production of fruit crops, we have concluded. Few farm families have enough fruit in their diet. Studies made in southern Iowa show that only about 5 farms out of each 100 produce as much fruit as the farm family needs. Usually, too, the small acreage that is used for fruit is the most nearly level—the most valuable land on the farm though it may not be most suitable for fruit. We need to turn to the hilly spots that have eroded, or would erode if we farmed them, for the place to plant our fruit trees and vines.

The fruit to be grown will probably be one of the following: Apples, pears, plums, peaches, cherries, grapes, cane fruits and strawberries. Peaches probably should not be attempted except in the three or four southern tiers of Iowa counties, and even there one cannot be too sure of getting a crop. The average farmer will probably be interested in growing two or three kinds of fruit, depending on his neighbors for other kinds. If you are in doubt about the varieties of fruit to plant in your region, consult the horticulturists at Iowa State College for recommendations.

**Preparing for Planting**

Here are our general recommendations for preparing the soil, based on our experiments at Floris:

1. **Contour Planting.** On hilly land, all fruit should be planted in rows on the exact contour. If the slope is not too steep, two or three or even more rows of cane fruit may be placed on one contour strip or bench terrace. Generally there should be only one row of fruit trees to each bench with the space between rows conforming to the original slope of the orchard.

2. **Terraces, Regular Type or Bench.** No larger terrace structure should be built than is necessary to control erosion. We have found that much of the problem of holding the soil in place can be done by growing pasture and meadow plants between the rows. This is a lot cheaper than building regular terraces and has the added advantage of not breaking up the original structure of the soil and helping build the soil while it is holding it down.

So we feel that terraces of the regular type probably should not be built unless you find that one or two terraces with a slight grade are needed to carry off some of the water from the slope. Even where this is necessary, we find that bench terraces on the exact contour should be used for the rows of fruit between the terraces.

If you are bothered about the problem of building these terraces, get in touch with the soil conservation technician in your district and with his help you can build the regular terraces with a plow. The fruit trees can then be placed on this terrace as well as on the plowed contour strips or bench terraces.

You can prepare the plowed contour strips or bench terraces for planting your orchard very easily and simply by using a horse-drawn plow, disk and harrow. Before starting to make the bench terraces, you should have all of the contour lines staked at the correct...
Here's a telescopic view showing a portion of the farm. In the foreground are grapes of various varieties, and in the background one of the experimental plum orchards.

plowed space left between the rows to prevent erosion.

After the contour strips are plowed they should be thoroughly disked and harrowed. If they are prepared in the early spring before planting, the disk and harrowing can immediately follow the plowing operation. If the plowing is done in the fall, our experiments show that it is better to delay disk and harrowing until the next spring. In fields having enough plant cover so that the space between the rows is protected over winter, the bench terraces have proved to be in better condition for early planting when the plowing was done in the fall before.

3. Plant Cover Between the Rows of Trees. Maintaining a good vegetative cover between the bench terraces (1) protects and builds the soil on the slope and (2) furnishes a handy source of mulching material. Usually mixtures of legumes and grasses make the best cover. The following crops have given good results: Korean lespedeza with or without bluegrass; birdsfoot trefoil and bluegrass or brome; alfalfa and bromegrass; prairie grass mixtures and two or three good pasture seeding mixtures. The higher the yield from the interplanting mixture, the more rapidly the soil will be improved, since none of the plant cover material is removed from the slope, but one must be careful to see that the grasses and legumes do not compete too much with the trees.

Soil and water have been conserved best when the plowed contour strips were prepared in fields already covered with vegetation. A good weed cover is much better than no cover. Weed covers can be replaced with legume-grass mixtures before or after the bench terraces are made. If you need to prepare a seedbed for the legume-grass mixtures, make sure that all of the strips are not plowed at once, leaving the entire slope unprotected from erosion.

In the experiments where the orchard was established on practically bare cropland, the tree rows were staked at the proper distance and the interplanting strips of grasses, legumes or mixtures were established the year before the bench terraces for the trees were prepared and planted. To plant the orchard on cropland, the first year a winter cover of hairy vetch and rye may be planted in the interplanting area as late as the first week in September the previous fall.

**Planting Space, Location**

The spacing between the rows of trees and vines will not be uniform because the rows are located on the contour. Spacing between two rows of each kind of fruit should not be closer than the smaller figure in the accompanying table. Two rows of apples, for example, should not be closer than 33 feet. If the space between two adjacent contour rows of the same fruit becomes twice this space, a short row may be put in. The space between plants in the row can be reduced when the space between the contour rows becomes greater. Between rows of different fruits, you can adjust the distance by averaging the least spacing for the two fruits.

For erosion control it seems better to place the row of trees near the lower side of the bench terrace and cultivate only on the upper side. The distance from the edge of the bench on the lower side should be not less than 1 foot for grapes, about 2 feet for plums, peaches and cherries, and about 3

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**RECOMMENDED SPACING OF FRUIT PLANTS AND TREES**

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Space between rows, feet</th>
<th>Space in rows, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>33 - 40</td>
<td>33 - 40</td>
</tr>
<tr>
<td>Pear</td>
<td>22 - 30</td>
<td>22 - 30</td>
</tr>
<tr>
<td>Cherry</td>
<td>18 - 32</td>
<td>18 - 20</td>
</tr>
<tr>
<td>Peach</td>
<td>16 - 20</td>
<td>16 - 18</td>
</tr>
<tr>
<td>Plum</td>
<td>16 - 20</td>
<td>16 - 18</td>
</tr>
<tr>
<td>Grape</td>
<td>8 - 10</td>
<td>8 - 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Space between rows, feet</th>
<th>Space in rows, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackberry</td>
<td>7 - 9</td>
<td>3 - 4</td>
</tr>
<tr>
<td>Currant and gooseberry</td>
<td>7 - 8</td>
<td>4 - 5</td>
</tr>
<tr>
<td>Black raspberry</td>
<td>6 - 8</td>
<td>4 - 5</td>
</tr>
<tr>
<td>Red raspberry</td>
<td>6 - 8</td>
<td>3 - 4</td>
</tr>
<tr>
<td>Strawberry</td>
<td>4</td>
<td>1 - 1½</td>
</tr>
</tbody>
</table>

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feet for apples. Apples and pears are the only trees which give much better results when planted in a row down the middle or slightly below the middle of the bench whether cultivated on one or both sides. Mulched trees or vines can be planted down the middle of the terrace because no room needs to be left on either side for cultivation.

**Cultivating Methods**

It is better to cultivate on only the upper side of the bench terrace than on both sides because of the difficulty of maintaining the downhill shoulder of the bench if it is kept tilled and bare by cultivation. This is especially true where the fruit is planted on steep slopes where the bench terraces must be narrow. For this reason it is better, if possible, to plant larger trees, such as apples and pears, on more gentle slopes where wider bench terraces can be made which will allow for at least 8 feet of cultivation or mulching. For some varieties of these larger trees cultivation or mulching on both sides of the row seems desirable.

One-horse cultivators, 5-shovel and double shovel, may be used to good advantage in bench terrace cultivation. Care must be taken in the use of the double shovel plow not to plow deep enough to injure the roots. For all of the fruits mulching gave at least as good results as cultivation and better erosion control. We expected more injury from plant diseases and insect pests because of mulching, but as yet (in 8 years) it has not developed. All pasture and meadow plants grown between the fruit rows, if not used on the benches for mulch, should be left in place to build up the soil of the orchard.

A method which has proved quite practical is to plant the rows of fruit trees slightly wider apart than the recommended spacing and maintain permanent strips of vegetables or truck crops down the middle of the interplanting space. On each side of a row of fruit trees on a cultivated or mulched bench terrace is a strip of permanent grass, legume or mixed cover. Beyond this on each side is a strip of vegetable or truck rows, beyond this a strip of the grass and legumes and then the tree row on a bench terrace.

**Value of Other Uses**

The value to the farm of making other uses of hilly land than for rotation cropping, pasture or forest will depend chiefly on the interest and effort of the farmer and the acreage and condition of the land available for these uses.

As soil conservation farm plans are completed for an increasing number of the farms in Iowa, it is becoming apparent that there is available, on almost every farm, at least an acre or two which is better adapted to fruit growing and other permanent agricultural crops than for anything else. On many farms the home site is the steepest and most broken part of the farm.

On these farms the hillculture orchard can well be placed close to the house and barnlot and be included in an over-all plan for the use and beautification of the home site and its protection from erosion and from wind. On other farms the unused area may even be on the "back 40."

We can hardly overestimate the value to the farm family of fruit and other woody plant crops which can be produced with little effort right at home under conditions which will insure complete erosion control and rapid soil building. No little part of the value of putting our hilly land to work is the interest which the entire family may have in it and the better use which can be made of the time of the different members of the family in off seasons.

Many of you may feel that your farm has too little cropland and too much rough, hilly land. A little well directed study and effort on the problem of the use of this excess hilly, eroded land can lead to a well developed plan for its full use. Practically all of the uses for hilly land which have been adapted or developed on the Iowa Cooperative Hillculture Farm may be expanded so that, on a given farm, one or more of them may be utilized to add materially to the income of the farm.