Good Tile Drainage

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TILE DRAINAGE is needed for the uniform disposal of excess soil moisture. Many thousands of acres of wet Indiana farm land is in need of improved tile drainage. Good drainage of naturally wet land is absolutely essential before investments in farm machinery for this land, fertilizers and other crop management practices will pay off. Remember though, not all wet land makes good cropland even after drainage.

Be sure that tile drainage is the method that will give the best and most economical drainage. Some wet sandy soils should be drained with open ditches. A third method, surface drainage, is best for some tight or silty soils. Tight soils require such close tile spacing that costs might exceed benefits. Some silty and sandy soils plug the tile rapidly. Even on soils that can be tiled, surface drainage should be used to remove water that stands in depressions.

Make Complete Plans Before Starting to Lay Tile.

Be sure to have an accurate survey made of the area to be tiled. This is needed to plan the most efficient and economical layout of mains and laterals. It will assure you that all low areas will drain and that you will have adequate cover over laterals. Plan your tile system for all the wet area in the watershed even if you intend to tile only a part of the area at this time. Sometimes, neighborhood cooperation will be required.

Be sure the tile is installed according to the survey and plan. You can be sure of this by engaging a competent contractor with good equipment.

A planned and properly installed drainage system is necessary to prevent uneven stands of crops and drowning such as this.
A drainage contractor setting a target at the proper height based on the proposed depth of trench at the grade stake.

See That Your Tile System Is Planned and Installed Using These Specifications.

Type of System.

In areas where the topography is generally flat and the natural drainage of all the soils is poor, a complete system of parallel spaced laterals should be planned. Laterals in the wetter areas can be installed first, others later. This systematic arrangement should take the place of the previously used poor practice of just tiling the low spots. In rolling topography where tiling is needed only to drain the waterways, the random system may be used. In seepy areas run tile lines across the slope and intercept seepage before it comes to the ground surface.

Installing drain tile to the grade and depth established by the survey. Note the attention the machine operator gives to sighting the targets.

Use Quality Tile.

Purchase only from the manufacturer whose tile meets the American Society for Testing Materials (ASTM) specifications. Tile meeting these specifications are your assurance of a product worth buying. Reject individual tile with deep cracks, large lime spots and honeycombed walls, as well as those that are out of round or warped. Quality clay or concrete tile will give equal results under most conditions. Unless concrete tile are of extra high quality, do not use them in acid soils. Concrete tile, unless properly steam cured, should be 28 days old before installation.

Outlet.

The outlet is the foundation of your tile system. No matter how carefully you install the rest of the drainage system, it will not work right if the outlet does not function properly. The outlet must be low enough to permit the placing of tile three to four feet below the surface in the low areas of the field. If you plan to use an existing tile main as an outlet, be sure it is large enough to handle the additional load of your new tile system. See that the low water flow in the ditch is at least a foot lower than the bottom of the outlet tile.
Relief Wells
Relief wells will reduce the pressure and hazards of blowouts if used at the end of steep sections and below surface inlets. Top of well should be about one foot above ground.

Protect the Outlet.
Protect the outlet against washout and erosion. Where there is no surface water to contend with, use a section of pipe. Where surface water and tile water discharge at the same location, a well designed structure is necessary.

Keep Out Small Animals.
Protect the end of the tile outlet with a removable iron rod grating or with a swinging metal gate.

Size and Depth of Main Lines.
Your engineer or contractor should consult a standard tile drainage chart to determine the required size of tile. (See back cover.) Every effort should be made to remove surface water by surface drains to relieve the load on the tile system. When no surface water is admitted directly to the tile, design the tile to remove ¾ inch of water in 24 hours from the area to be drained. Where open surface inlets must be used, remove ¾ inch in 24 hours from the entire drainage area. Where blind inlets are used, remove ½ inch in 24 hours. Double these rates for truck crops. The number of acres to be drained and the grade of the tile line are other factors that help to determine the size of main lines.

Mains should be deep enough to provide outlet for all laterals. Where extra deep cuts and/or extra wide trenches are encountered, loads on tile should be checked. Use tile of adequate strength to support the load.

Grades of Main Lines.
For eight and ten-inch tile, the grade should be not less than 0.06 foot per 100 feet; for 12-inch tile and larger, the grade should be not less than 0.05 foot per 100 feet. Avoid very steep grades, if possible. Steep grades on main lines require special construction according to soil type and conditions to insure continued operation. When using butt-end drain tile for main lines designed to flow full and when using ordinary construction, do not exceed these grades:

<table>
<thead>
<tr>
<th>Soil</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sands and sandy loam</td>
<td>1.0</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Silt and silt loam</td>
<td>2.0</td>
<td>1.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Clay and clay loam</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Quarter-inch iron rods spaced one and one-half inches apart make a suitable grating to keep out animals.
Spacing and Depth of Laterals.

The kind of soil determines the spacing and depth. The spacing for truck crops should be \( \frac{1}{2} \) the spacing for field crops. General recommendations for for field crops are:

<table>
<thead>
<tr>
<th>Material</th>
<th>Spacing (Feet)</th>
<th>Depth (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Loam</td>
<td>40-80</td>
<td>36-42</td>
</tr>
<tr>
<td>Silt Loam</td>
<td>50-100</td>
<td>36-42</td>
</tr>
<tr>
<td>Muck (deep)</td>
<td>80-200</td>
<td>48-60</td>
</tr>
</tbody>
</table>

Connections.

For quick, safe installation, use manufactured "T" or "Y" branches. When these are not available, the junction tile should be chipped, fitted, and sealed with mortar. Laterals may enter main lines at right angles and need not be angled downstream.

Junction Boxes.

Where two or more tile mains are joined together, consider the use of junction boxes constructed from concrete or concrete blocks.

Beware of shallow tile. Provide at least two feet of soil over the top of the tile at all locations. The hazards are heavy loads and frost damage.

The best way of joining a lateral tile to the main is with a manufactured fitting.
Joints.

Drainage water enters the tile line at the open joints between tile—not through the walls of the tile. The gap between tile should be varied according to soil conditions:

- Sandy Soil ............... Tight fit
- Silt Loam and Silty
  Clay Loam ............... About ¼ inch
  Clay .................... ¼ to ⅛ inch
- Peat and Muck ........... ¼ to ⅛ inch

Blinding.

A map or record of the tile system such as this aerial photograph should be made and filed with other important farm papers.

Place topsoil over the tile immediately after laying. This lets water pass freely into the tile and holds the tile in place in case of rain and when backfilling. In sands or tight soils, you may need to blind tile with gravel, hay, straw, corn cobs, or other available material. A fiberglass sheet is now being manufactured for this purpose.

Checking Grade.

See that all flat grades, all changes in grade, and all turns are checked with a surveyor’s level. Do this after the tile have been laid and before the trench is backfilled. This is the time to catch mistakes.

Avoid Trees.

Tree roots will clog your tile. Remove all water-tolerant trees such as willow, elm and cottonwood within 75 feet of the tile line. It is good practice to keep all other trees 50 feet or more from mains. When this is not possible, use sewer pipe with cemented joints. However, there is still danger of the tile filling with roots.

Map the Drainage System.

Have your engineer or contractor provide a map or make one yourself showing the location and size of all tile lines and the depth and grade of the main. A good aerial photograph taken soon after the tile are installed makes a good location record. An aerial photograph of your farm to a definite scale may be purchased from the U. S. Department of Agriculture. This makes a good base map on which to draw the tile system. A map of the drainage system will be quite valuable when adding to the system or if you sell your farm. Put it away in a safe place. A good idea is to attach a copy to your deed.

Maintenance.

Regular inspection of your tile system is essential. Prompt repair of any tile failures will keep the system in working order and prevent permanent damage to the entire system. Use a crop rotation with deep rooted legumes to insure the highest degree of drainage from your tile system over the years.
TILE DRAINAGE CHART
ACRES DRAINED BY VARIOUS SIZES OF TILE

Space between lines is the range of tile capacity for the size shown between lines.

\[ V = \text{velocity in feet per second} \]
Reference: Yarnell-Woodward Formula \[ v = 138r^{2/3} \]  
U.S.D.A. Bulletin 854