Drainage
FACTSHEET

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IRON OCHRE PROBLEMS IN AGRICULTURAL DRAINS

Iron ochre in subsurface drainage systems can result in poor performance or complete failure of the system. It occurs throughout the world and can be found in various places within the Fraser Valley. Clogging of drains can be a short or long-term problem depending on the soil characteristics. Various detection and control methods have been developed with varying degrees of success.

REGIONS AFFECTED BY IRON OCHRE

In the Fraser Valley, it has been estimated that 5% to 10% of the tile installed has iron ochre clogging problems. Field observations indicate that Fort Langley, Huntingdon, Westham Island, North Delta, Yarrow, Sumas Lake bottom and parts of Matsqui are areas in which iron ochre is a problem. Iron ochre is not necessarily wholly confined to these areas nor are these areas entirely affected. Iron ochre may not completely affect an individual field. It is common to find portions of a field's drainage system clogged while other parts of the system within the same field being trouble free.

DESCRIPTION OF IRON OCHRE

Iron ochre is a yellow tan or red jelly-like substance most easily observed in open ditches and drain outlets. When wet, it is generally a red slimy substance. Upon drying, it shrinks becoming flakey.

Iron ochre is composed of many compounds but mostly contains iron deposits mixed with bacterial slime. It is this slime which causes failure of subsurface drainage systems by clogging the pipe perforations, sealing the filter material and filling the internal volumes of the drains.

FORMATION OF IRON OCHRE

The raw material needed for iron ochre formation is ferrous iron. Iron oxidizing bacteria must also be present as iron alone would not form this sticky slime. When the ferrous iron enters a drain tile, it is immediately oxidized by the iron bacteria. The combination of the iron compounds formed and the bacterial slimes is iron ochre.

Most soils contain iron in forms that are not soluble and do not present a problem for drainage systems. Weathering processes cause the breakdown of the tough chemical bonds which keep iron immobile in the soil. The result of this is ferrous iron when the soil is wet or ferric iron if the soil is dry. The iron will readily transform from ferric to ferrous upon wetting of the soil profile.

This iron is located on the surface of the soil particles. The strength at which the iron is held upon the soil particles is dependent upon the soil type. For example, iron is held loosely upon sands and tightly upon clays. This phenomenon explains why iron ochre clogging problems can be severe in sandy soils during the first few years after system installation, with a subsequent reduction in the problem later on, however. Clogging problems in clay soils may persist for a long time.

Clogging of the drain may occur quickly or may build up slowly. It also can be a short-term problem or persist for a long time. This is determined by soil properties such as pH, amount of soluble iron, amount of organic matter and dissolved iron in ground water. Organic matter can increase clogging problems because it contains compounds which enhance the mobility of the ferrous iron in the soil.

Gelatinous ochre can form in ditches or be present on seepage faces of ditches and banks. Red streaks of iron in the subsoil can also indicate a high content of ferrous iron. Organic layers in the soil can also contribute to ochre formation. Neighboring drainage systems can, in some situations, give an indication of what to expect should the soil type be the same.

Differences between temporary and permanent clogging sites can be determined on the basis of soil type and topography. Field studies have generally found temporary clogging problems in sands, with more severe longer lasting problems in clays and mixed profiles containing organic matter. Areas that receive groundwater containing soluble iron from other regions have the potential to be permanent iron ochre sites. Often water discharging into a valley has travelled several miles through different types of soils and rock formations collecting soluble iron.

Sites that have not displayed ochre problems in the past can appear to suddenly be affected. This usually is associated with the management practices being performed on the land. Large quantities of manure can add organic matter and over-fertilization can lower the pH. These activities affect the soil chemistry causing iron to become more mobile.

CONTROL OF IRON OCHRE

It must be emphasized again that there is no current solution to the permanent iron ochre problem. Many techniques have been investigated to control iron ochre, which have had varying degrees of success. The key to good control is keeping on top of the system maintenance. Ochre that is left to age and harden can become virtually impossible to remove. Various techniques and procedures that have found to control ochre clogging are listed below:

1. Laterals should preferably drain into an open ditch rather than a main collector as often only a small area within a field can be problem causing. This will prevent clogging of the entire system and reduce the time required in cleaning.
2. If laterals must join to a main collector, they should be installed with a Y connection in addition to the T-joint to the main line to allow access for jet cleaning without having to disconnect the lateral from the mainline.
3. Good soil structure is important for many different reasons. It will reduce ochre problems by allowing fast percolation of water through the soil, minimizing waterlogged conditions, maintaining good aeration and therefore promoting oxidation of iron in the soil.
4. Drain laterals should not be longer than 200 m as they are difficult to clean with high pressure cleaning nozzles. The chief difficulty with longer lengths is the inability of the high-pressure nozzle in overcoming the friction of the hose dragging behind it.
5. Avoid using backfill materials other than coarse gravel, as other materials will eventually clog.
6. Mechanical cleaning by jetting should be done within the first year rather than waiting for the pipe to severely clog. In sandy soils, operating pressures at the nozzle should not exceed 2,750 kPa, as too high a pressure will cause considerable damage to the envelope of material surrounding the pipe. Sand will be swept into the pipe if this occurs.
7. Drain tubing with large slits (1.2 – 1.5 mm) but preferably with 12.5 mm holes will resist clogging longer than small holes and slits. Drain tubing with cleanly cut holes and slits should be used, as ochre will preferentially stick to frayed edges.
8. Increased pipe grades will enhance the self-cleaning process and make low-pressure cleaning more effective.

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