Soil Drainage Management

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What is field drainage?

Answer = The control of excess soil water by natural or man made means

- Aid the removal of excess soil water through slowly permeable soils
- Control rising groundwater
Types of pipe
Odd ones

Stone

Plastic
Placing gravel fill into hopper above pipe

New drain depths are normally 0.7 to 1.5m depending soil type
Why control soil water?

• To provide a better growing environment
  • Allows improves plant access to water and oxygen; reducing waterlogging and drought.
  • Reduces competitive weeds and parasites
  • Reduce soil and nutrient losses – agricultural and environmental benefit

• To provide a greater period when the land can be stocked, worked and trafficked
Weeds vs Crop - Cultivations

Better drainage means:

• deeper inversion ploughing (one way to kill weed seeds) is less likely to smear soils.

• cereals can be sown later in the year, with less risk of soil damage, disrupting the blackgrass establishment and giving cereals a better head start

• better chance to establish a good seed bed, which helps establish a more competitive crop

• possible to sow spring crops earlier - benefit?
Weeds vs Crop – Crop Health

- Cereals more susceptible to stress from waterlogging than many problematic weeds
- Better emergence from warmer seedbed gives healthy more vigorous growth and less damage from slugs
- The above factors (and those on the previous page) increase competitiveness of wheat in the fight over nutrients
- Reducing nutrient loss that results from leaching and run-off means these are available to the crop
Drainage as a weed control measure?

- Good drainage will hold back some weeds pretty effectively
- Warmer, drier soils results in reduced survival rates of dormant blackgrass seeds
- Good drainage is not a blackgrass slayer! - but with increasing herbicide resistance, you need all the help you can get
Black-grass control associated costs

Source: J. Willmott, Strutt and Parker (via FG Insight website)

Example Wheat & OSR on Circa 1,000 ha in Bedfordshire

<table>
<thead>
<tr>
<th>Increase in farm cost</th>
<th>£/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>£100,000 in extra depreciation cost</td>
<td>£13,000</td>
</tr>
<tr>
<td>Finance</td>
<td>£2,000</td>
</tr>
<tr>
<td>One more staff member at 75% of time</td>
<td>£23,000</td>
</tr>
<tr>
<td>Additional herbicide cost</td>
<td>£34,000</td>
</tr>
<tr>
<td>Total extra cost to farm of black-grass control</td>
<td>£72,000 (6% increase in overall farm costs)</td>
</tr>
<tr>
<td>Plus extra seed to compensate for later drilling, more competition</td>
<td>?</td>
</tr>
</tbody>
</table>

• Having to move to spring crops = less profit?
Some other costs of poor drainage maintenance

- Poor field access
- Soil damage and mitigation
- Reduced yields
- Less potential for higher value crops
- Soil & nutrient loss
- Liverfluke & PPP
- Flooding
- Drainage repairs and premature renewals
Example tracksheet (two ages of existing drainage schemes)
Just one blocked drain can do this. And worse!
Most drainage systems are now over 30 years old and may now not be fit for modern farming or climate
Historic stone filled trench drains severed
The cumulative effect
Not just the pipes and stone!

- Mole drains
- Subsoiling
- Stone/Gravel trenches

Figure 21.51 Mole plough and resulting soil disturbance

Layout of piped drainage and mole drains
Leg cracking important for success

Should you increase frequency of moling?
Moles gradually deteriorate over time, particularly after unusually wet periods. So re-moling would increase maximum mole capacity (and fissuring) between mole formation dates.
Maintain good topsoil structure

Maintain good subsoil structure

A very helpful book from the Environment Agency
<table>
<thead>
<tr>
<th>Crop</th>
<th>Depth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter wheat</td>
<td>120</td>
</tr>
<tr>
<td>Spring barley</td>
<td>120</td>
</tr>
<tr>
<td>Grass</td>
<td>100</td>
</tr>
<tr>
<td>Oilseed rape</td>
<td>150</td>
</tr>
<tr>
<td>Potatoes</td>
<td>70</td>
</tr>
<tr>
<td>Field beans</td>
<td>75</td>
</tr>
</tbody>
</table>
Good Structure (Bromesgrove)
Good subsoil structure
Poor topsoil structure
Poor Structure
Poor Structure
Historic problems (Bromesgrove)
Platy structure – compacted soil (Bromesgrove)
Poor subsoil structure
Good & Bad topsoil structure
Improving damaged soil structure
Subsoiling guidance

- Set tines to just below the level of compaction

- Not too wide. Tine spacing:
  - 1-1.5 x tine depth (conventional)
  - 2-2.5 x tine depth (winged tines)

- Subsoil in dry conditions
- Good drainage needed in soil below

- If a specific compaction issue has not been identified you are probably better off doing nothing!...
Maintaining Good Drainage

• Clean ditches (for the sake of your land and that of your neighbours)
• Locate and keep outfalls clear
• Jet, rod or replace blocked sections
• Renew drainage where necessary
• Mole drainage or subsoiling
• Good soil and field management
Finding the drains
Finding drains
Finding outfalls
## Renewing drains

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Gravel fill</th>
<th>£ per ha</th>
<th>£ per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 m spacing*</td>
<td>No</td>
<td>£1.5 - 2.25k</td>
<td>£0.6 - 0.9k</td>
</tr>
<tr>
<td>20 m spacing*</td>
<td>Yes</td>
<td>£2.4 - 3k</td>
<td>£1 - 1.2k</td>
</tr>
<tr>
<td>40 m spacing*</td>
<td>Yes</td>
<td>£1.2 - 1.5k</td>
<td>£0.5 - 0.6k</td>
</tr>
<tr>
<td>Mole ploughing**</td>
<td>-</td>
<td>£100</td>
<td>£40</td>
</tr>
<tr>
<td>Subsoiling**</td>
<td>-</td>
<td>£200-300</td>
<td>£80-120</td>
</tr>
<tr>
<td>Ditch cleaning**</td>
<td>-</td>
<td></td>
<td>£1-3 per metre</td>
</tr>
</tbody>
</table>

* John Nix 2015  
**When done by contractor
Working well

Drainage outfall freely flowing

Well maintained ditch

Culvert: Correctly sized, set at the correct level and with its’ mouth kept clear
Typical problems
Effect of poor soil drainage on soil, nutrient and crop loss
Manage Surface Runoff

- Sit trap chamber with inclined trash grating
- Cross-drain
- Drain to soakaway in underlying flint/chalk (assisted by gravel pit if required)

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Right to maintain and renew drainage

But designs should be compliant with land drainage law, protecting land drainage rights of individuals and habitats.

Right to receive and obligation to supply drainage flows, without causing nuisance

- Flow rates are restricted
- Diversions should be avoided
- Maintenance is needed for the farmer and his neighbour
Summary

Good soil drainage is fundamental for healthy crops, healthy livestock, clean river water and longer periods for efficient field activities.

Do not neglect such an expensive and valuable asset!
Thank you

Kirk Hill, ADAS