Soil Drainage Management

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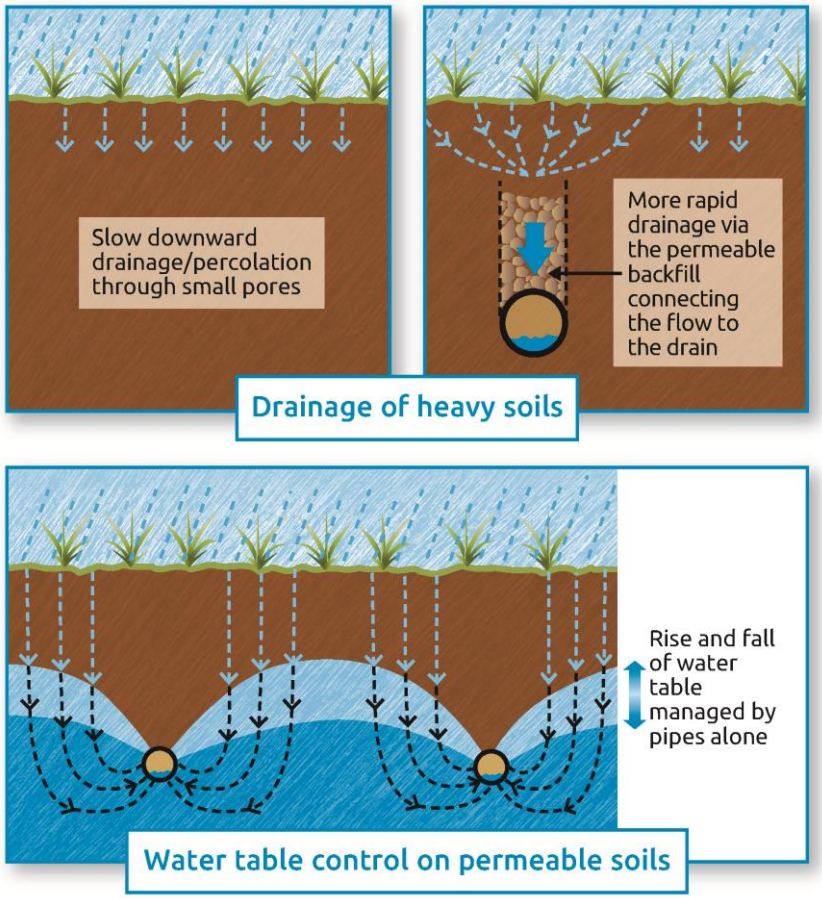
What is field drainage?

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

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Odd ones

Plastic

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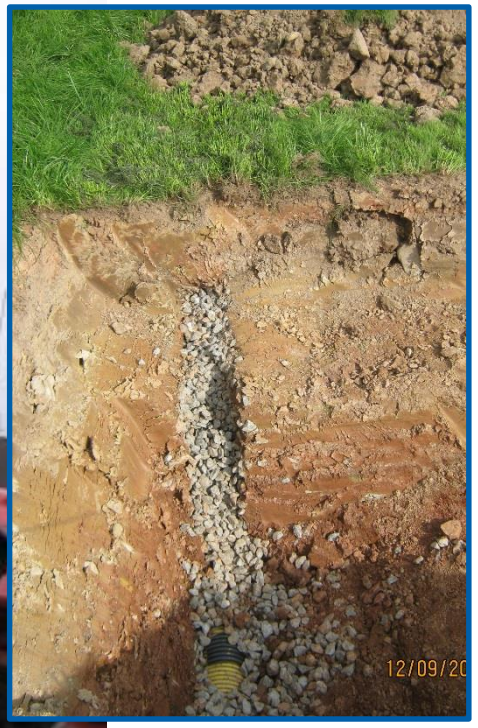
Placing gravel fill into hopper above pipe



New drain depths are *normally* 0.7 to 1.5m depending soil type

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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**

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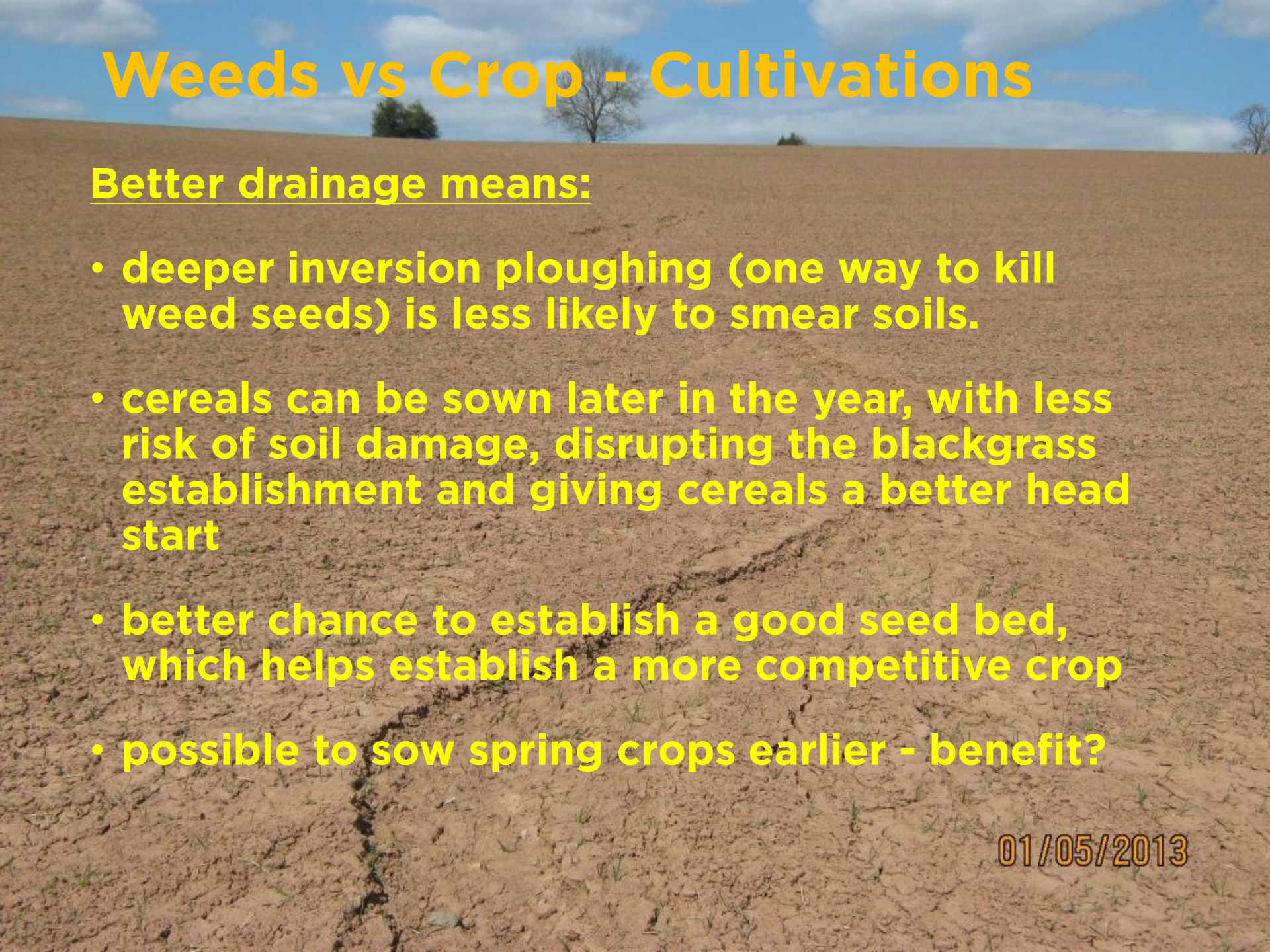
Weeds vs Crop - Cultivations

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

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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

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

- Having to move to spring crops = less profit?

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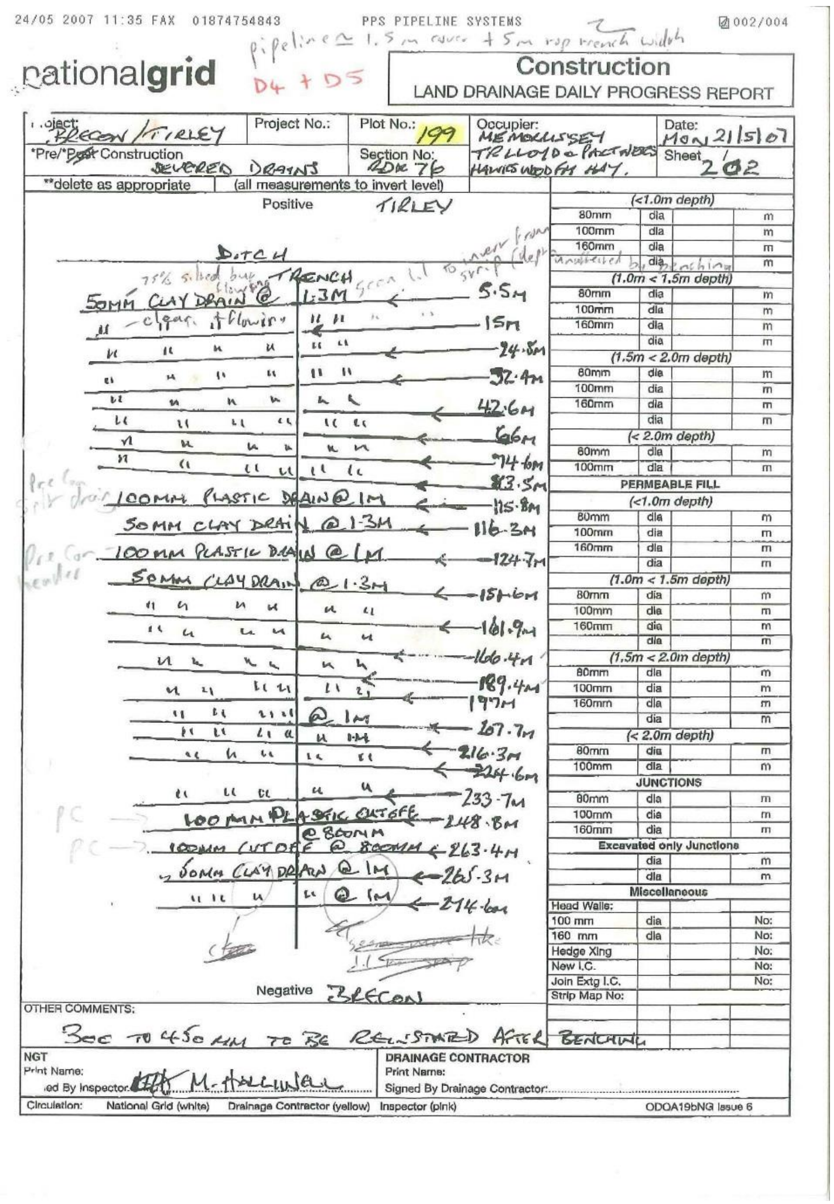
Some other costs of poor drainage maintenance

- 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)


24/05 2007 11:35 FAX 01874754843 PPS PIPELINE SYSTEMS 002/004

nationalgrid

Construction
LAND DRAINAGE DAILY PROGRESS REPORT

Project: BRECON / TIRLEY	Project No.:	Plot No.: 199	Occupier: ME MORRISSEY	Date: MON 21/5/07
*Pre/*Post Construction SEVERED DRAINS		Section No:		Sheet 2 / 2
**delete as appropriate	(all measurements to invert level)			

Positive TIRLEY

DITCH — TRENCH

50MM CLAY DRAIN @ 1.3M — 5.5M
15M
24.8M
32.4M
42.6M
66M
74.6M
83.5M
100MM PLASTIC DRAIN @ 1M — 115.8M
50MM CLAY DRAIN @ 1.3M — 116.3M
100MM PLASTIC DRAIN @ 1M — 124.7M
50MM CLAY DRAIN @ 1.3M — 151.6M
161.9M
166.4M
189.4M
197M
@ 1M — 207.7M
216.3M
224.6M
233.7M
100MM PLASTIC CUTOFF @ 800MM — 248.8M
100MM CUTOFF @ 800MM — 263.4M
50MM CLAY DRAIN @ 1M — 265.3M
@ 1M — 274.6M

Negative BRECON

(<1.0m depth)		
80mm	dia	m
100mm	dia	m
160mm	dia	m
	dia	m
(1.0m < 1.5m depth)		
80mm	dia	m
100mm	dia	m
160mm	dia	m
	dia	m
(1.5m < 2.0m depth)		
80mm	dia	m
100mm	dia	m
160mm	dia	m
	dia	m
(< 2.0m depth)		
80mm	dia	m
100mm	dia	m
PERMEABLE FILL		
(<1.0m depth)		
80mm	dia	m
100mm	dia	m
160mm	dia	m
	dia	m
(1.0m < 1.5m depth)		
80mm	dia	m
100mm	dia	m
160mm	dia	m
	dia	m
(1.5m < 2.0m depth)		
80mm	dia	m
100mm	dia	m
160mm	dia	m
	dia	m
(< 2.0m depth)		
80mm	dia	m
100mm	dia	m
JUNCTIONS		
80mm	dia	m
100mm	dia	m
160mm	dia	m
Excavated only Junctions		
	dia	m
	dia	m
Miscellaneous		
Head Walls:		
100 mm	dia	No:
160 mm	dia	No:
Hedge Xing		No:
New I.C.		No:
Join Extg I.C.		No:
Strip Map No:		

OTHER COMMENTS:
300 TO 450 MM TO BE REINSTATED AFTER BENCHING

NGT
Print Name:
Signed By Inspector: M. HALLIWELL

DRAINAGE CONTRACTOR
Print Name:
Signed By Drainage Contractor:

Circulation: National Grid (white) Drainage Contractor (yellow) Inspector (pink) ODOA19bNG Issue 6


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!

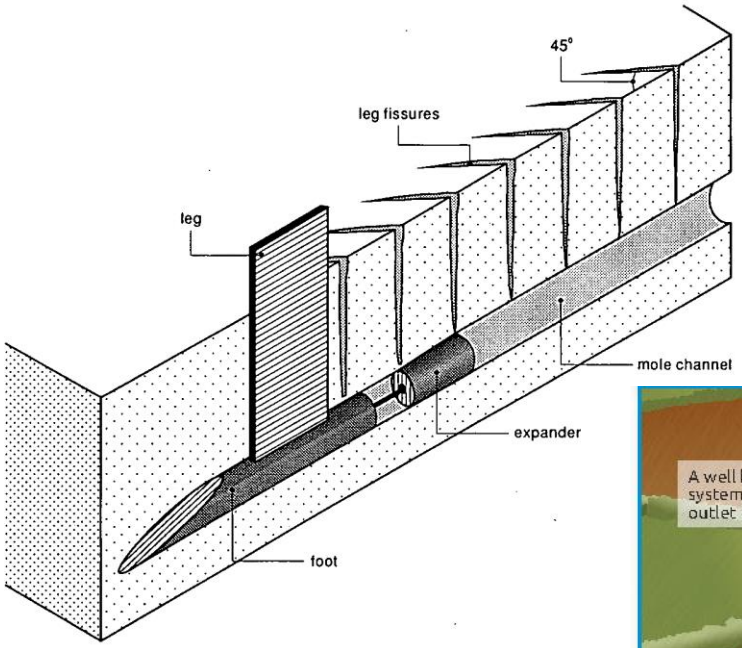
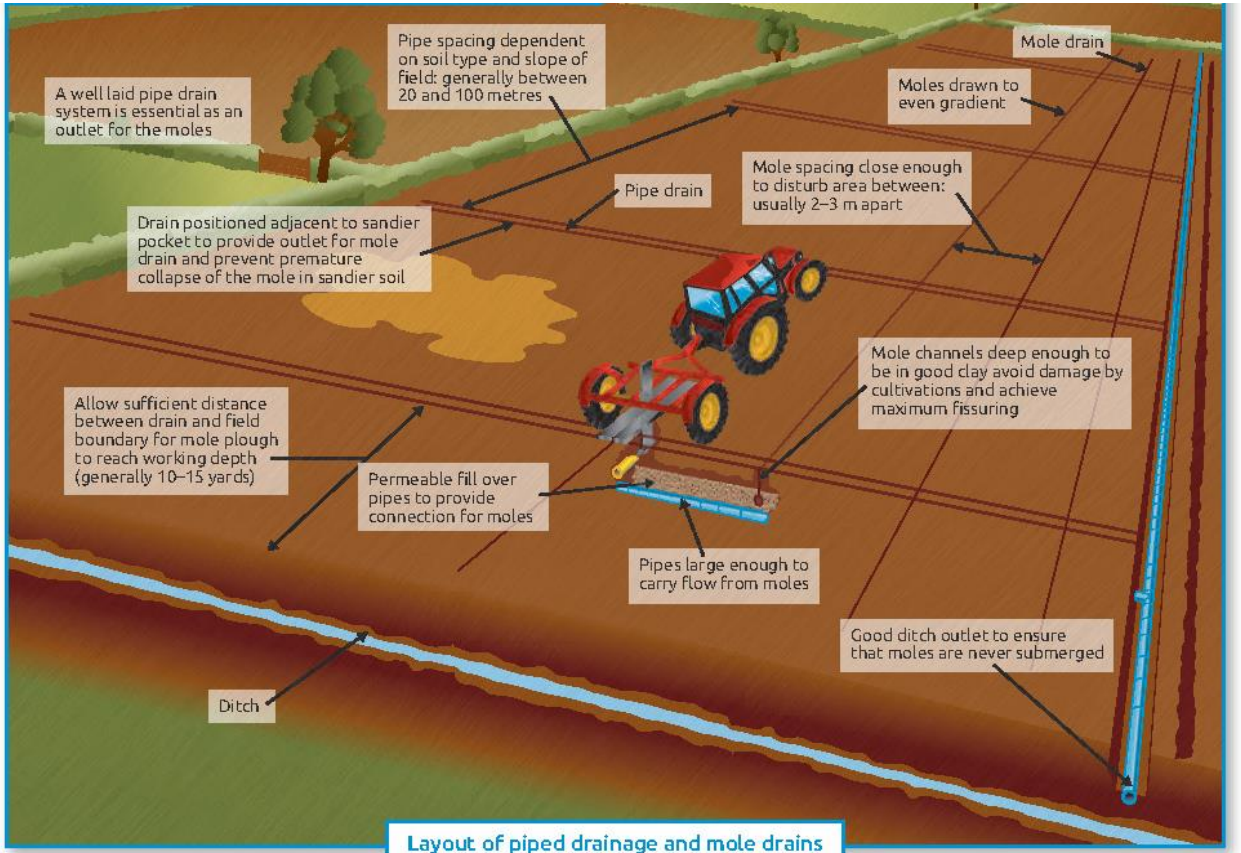


Figure 21.51 Mole plough and resulting soil disturbance

- Mole drains
- Subsoiling
- Stone/Gravel trenches



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.

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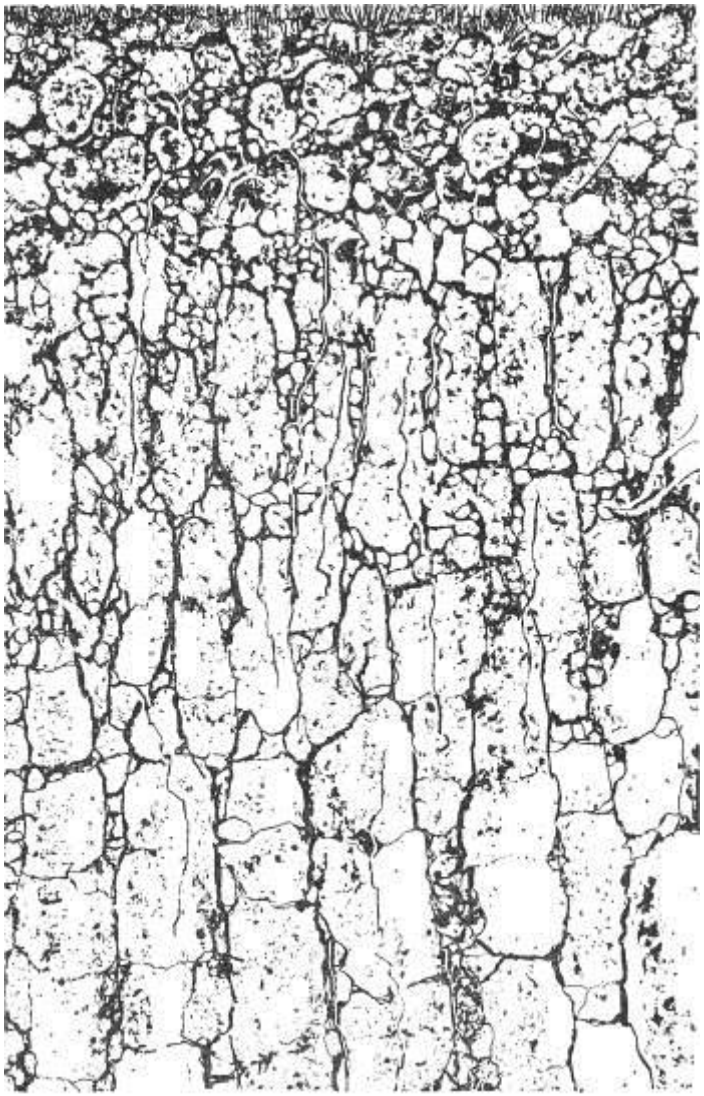
Maintain good topsoil structure

Maintain good subsoil structure



0

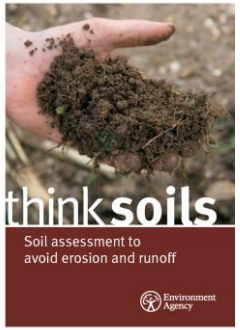
10 cm

30 cm

60 cm

90 cm

A very helpful book from the Environment Agency



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Typical rooting depths

	cm
Winter wheat	120
Spring barley	120
Grass	100
Oilseed rape	150
Potatoes	70
Field beans	75

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

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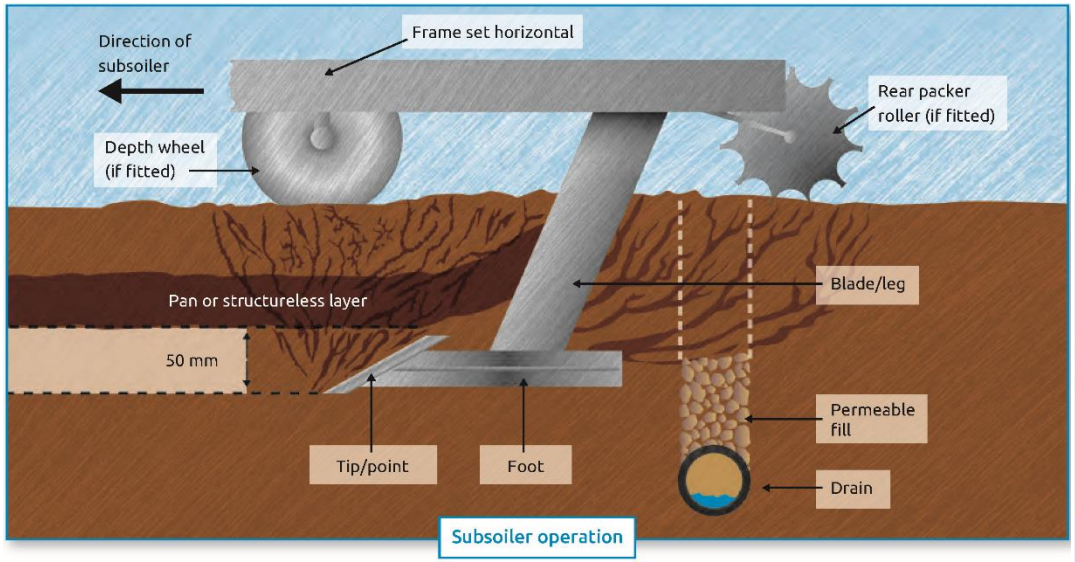
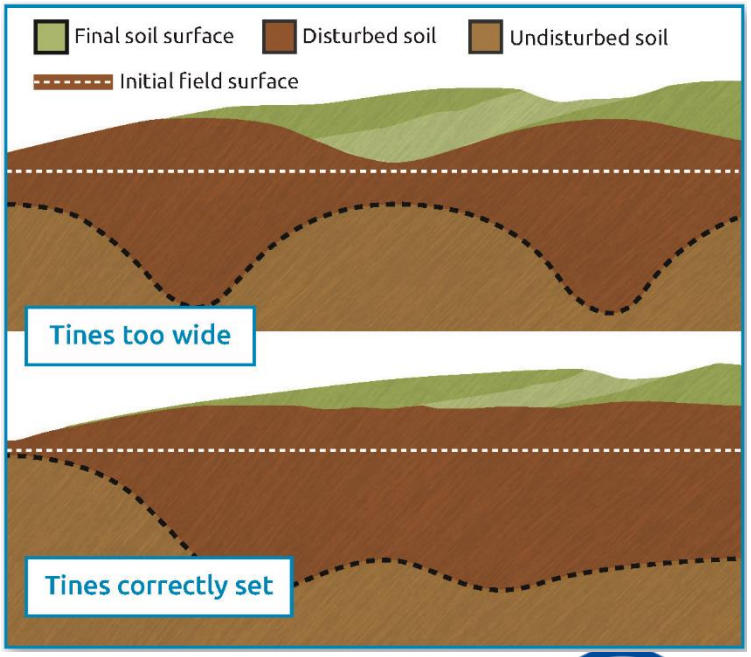
Subsoiling guidance

- 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)



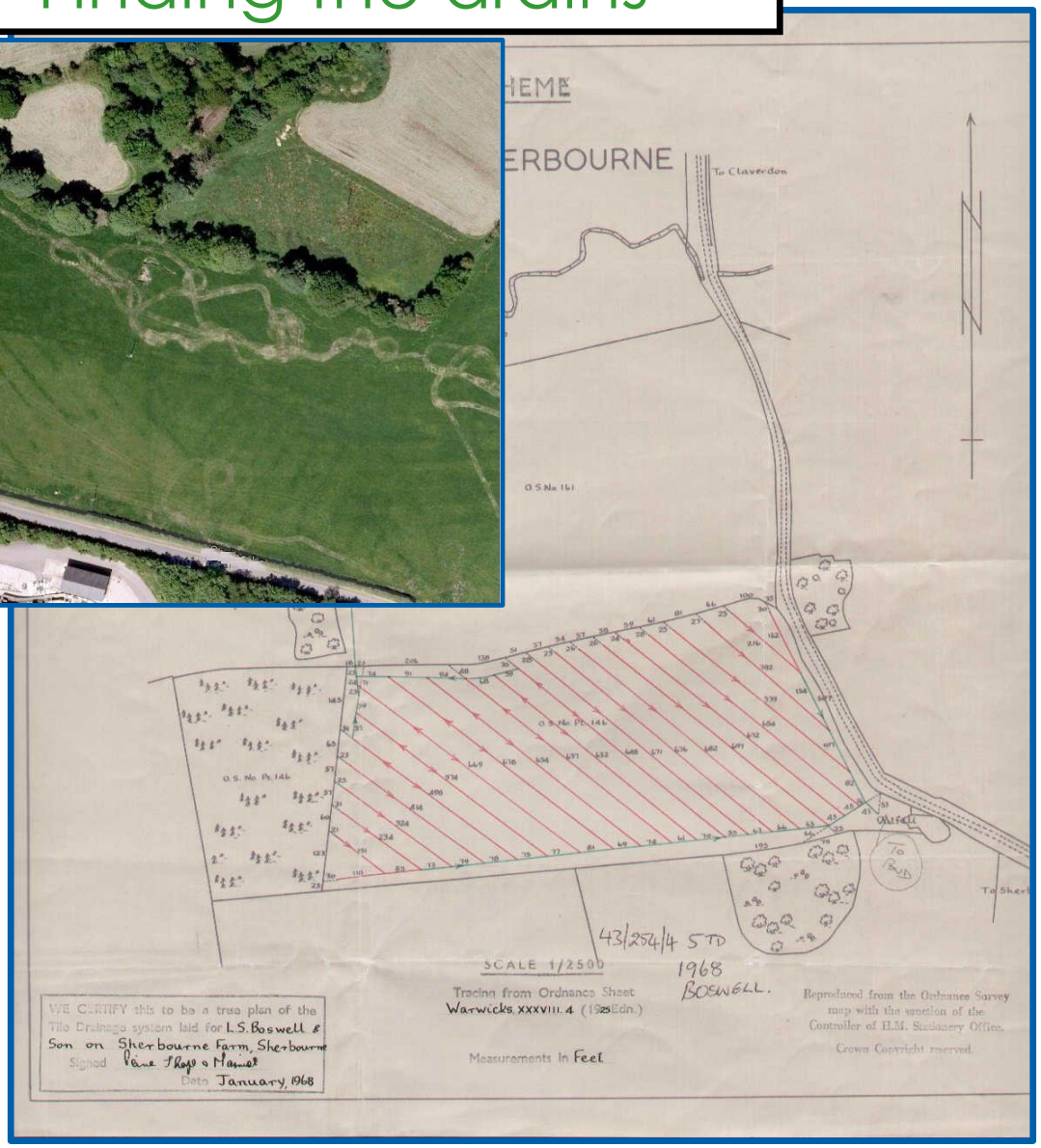
- **Subsoil in dry conditions**
- **Good drainage needed in soil below**

- 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



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Finding drains

Finding outfalls

AHDB
AGRICULTURE & HORTICULTURE DEVELOPMENT BOARD

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Renewing drains

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

* John Nix 2015

**When done by contractor

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Working well

Drainage outfall freely flowing

Well maintained ditch

Culvert: Correctly sized, set at the correct level and with its' mouth kept clear

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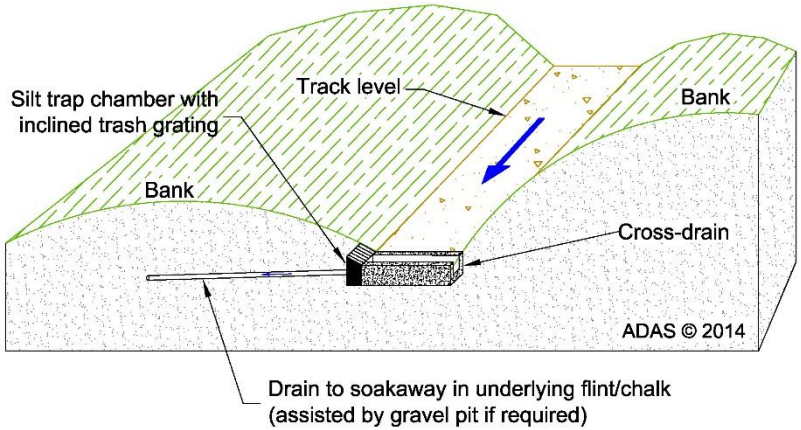
Typical problems

Effect of poor soil drainage on soil, nutrient and crop loss

Manage Surface Runoff



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

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Summery

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