Salaojituksen suunnittelu ja toteutus irlantilaisittain: Osa 2 Kuoppatesti ja vedenläpäisykyvyn määritys

Pat Tuohy, Owen Fenton

3.10.2018 Ilmajoki
4.10.2018 Loimaa

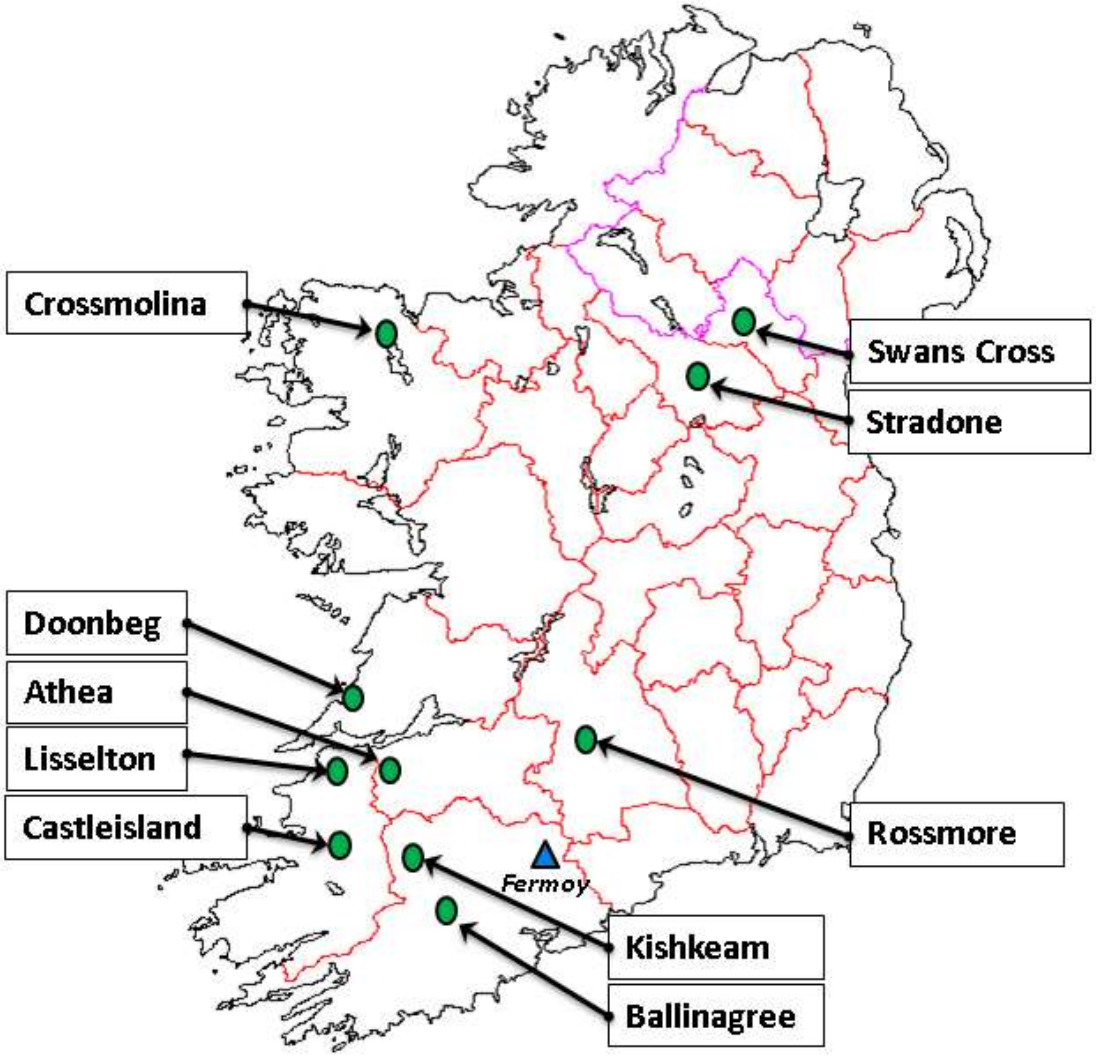
Euroopan maaseudun kehittämisen maatalousrahasto: Eurooppa investoi maaseutualueisiin.

The Irish Agriculture and Food Development Authority

Kuoppatesti

Menetelmä kehitettiin “Heavy Soils Programme” koetiloilla

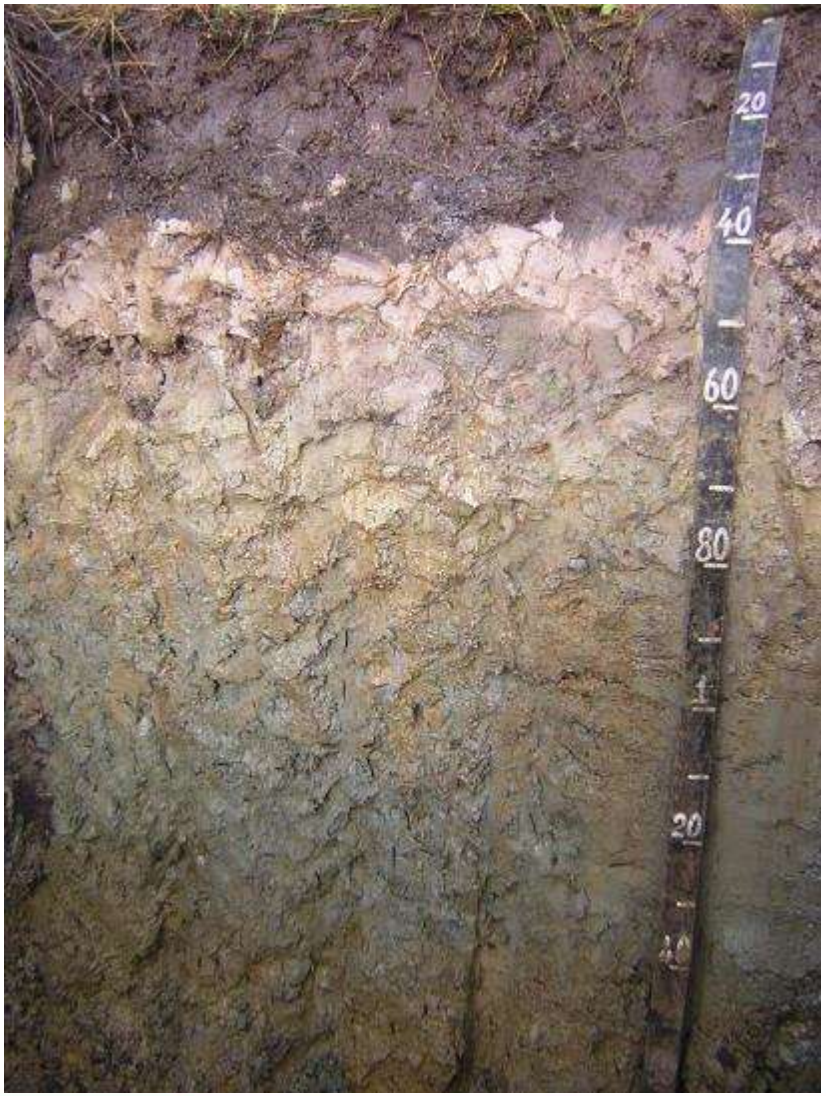
Heavy Soils Programme koetilat

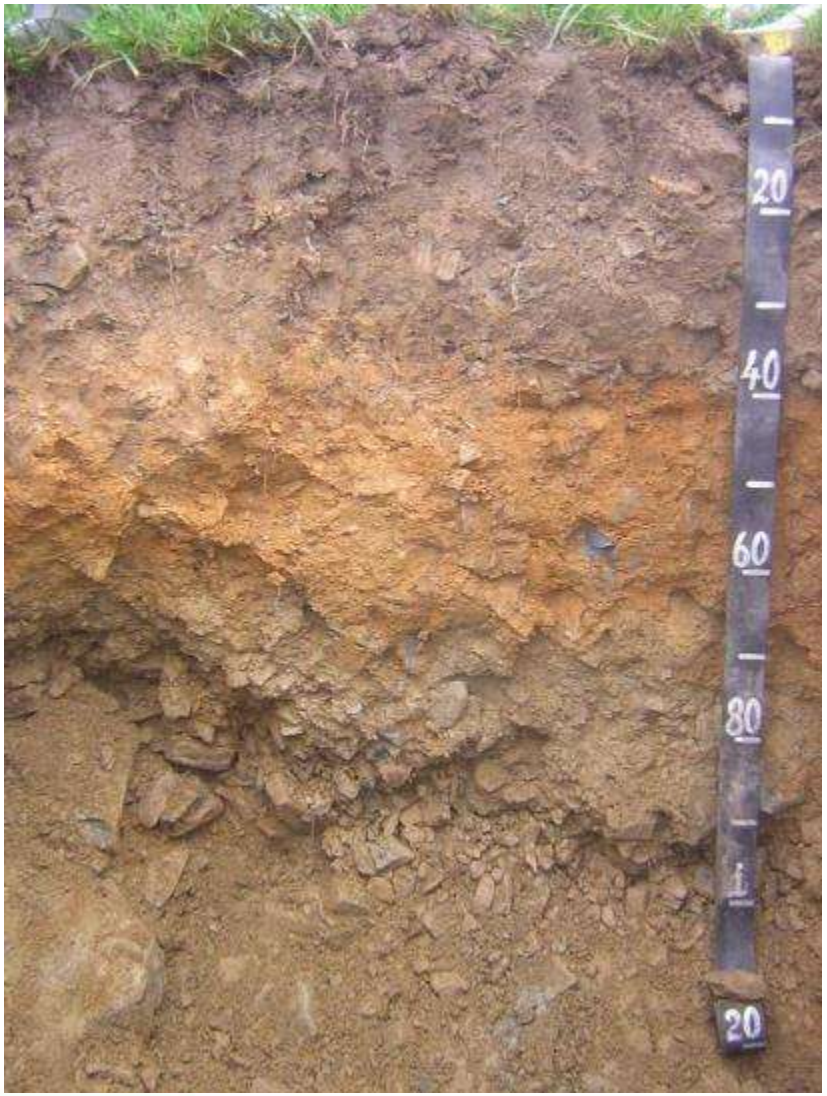


Vaihe 1: Kuoppatesti

- **Suunnittelun aluksi selvitetään, miksi kuivatustilanne on heikko**
- “Vakioratkaisut” eivät sovellu kaikkialle
- Useita maakuoppia kaivetaan ojitettavalle alueelle (vähintään 2,5 m syviä)
- Kaivettaessa tarkastellaan maaprofiilia kuopan reunoissa
- **Onko maassa veden kulkua estäviä kerroksia?**

TÄRKEÄÄ:
Mistä voidaan tunnistaa hyvä vedenläpäisykyky?


20
40
60
80
20


20
40
60
80
20


20
40
60
80
20
40


20
40
60
80
20
40

Vaihe 2: Mitä tarkastellaan?

Mistä tunnistaa hyvän vedenläpäisykyvyn?

- Helposti murustuva/luhistuva – yleensä vettä tihkuu kuoppaan

Muita merkkejä läpäisykyvystä

- Tiiviit kerrokset (rautasaostuma, mangaani, kyntöantura) tai sementoituneet kerrokset
- Maalaji

Lisää tuntomerkkejä:

- Maan huokoisuus
- Maan rakenne

Huokoisuus

VOIDS (POROSITY): Voids include all space in the soil. Porosity φ is the fraction of the total soil volume that is taken up by the pore space.

Good: Soils have many macropores between and within aggregates

Hyvä

Moderate: Macropores are fewer but are present on close examination

Keskinkertainen

Poor: No visible macropores, massive structureless smooth surfaced, sharp edges

Huono

Grade of structure: Describes the grade of development of the structure.

Table 35: Classification of the grade of structure

Code	Definition	Description
WE	Weak	Aggregates barely visible in situ and only weak arrangement of natural surfaces that break when gently disturbed.
WM	Weak to moderate	Show weak and moderate properties
MO	Moderate	Aggregates are visible in situ and there is a distinct arrangement of material. When disturbed it breaks into a mixture of entire and broken aggregates.
MS	Moderate to strong	Show moderate and strong properties
ST	Strong	Aggregates are clearly visible in situ and there is prominent arrangement of material. When disturbed it breaks into distinct whole aggregates.

L	Low	2-5%
M	Medium	5-15%
H	High	15-40%
VH	Very High	> 40%

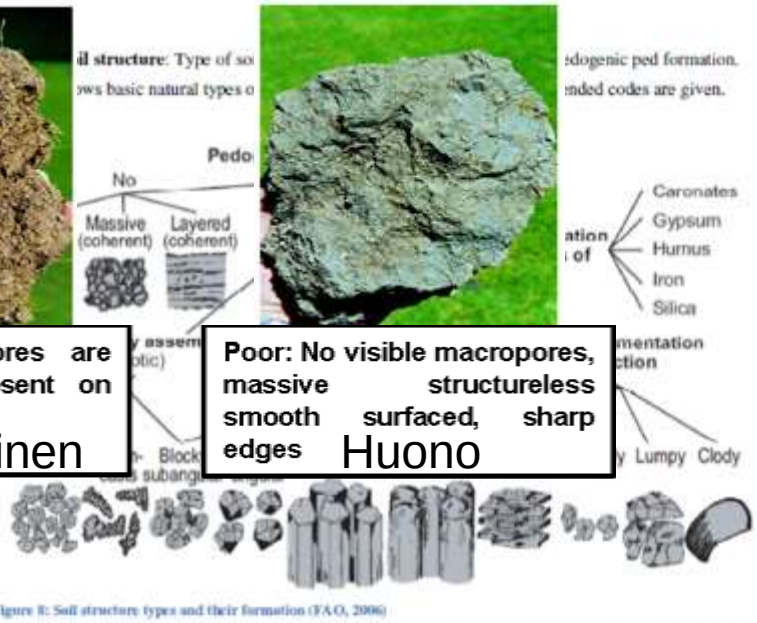


Figure 8: Soil structure types and their formation (FAO, 2006)

(Irish Soil Information System: Soil Profile handbook, 2008)

Läpäisevyyden tuntomerkkejä:

- Koostumus: tahmeus ja muovattavuus

Table 40: Classification of soil stickiness

Code	Definition	Description
NST	Non-sticky	No soil material adheres to thumb and finger after release of pressure
SST	Slightly sticky	Soil material adheres to thumb and finger after release of pressure, but it is easily removed.
ST	Sticky	Soil material adheres to thumb and finger after release of pressure, and tends to stretch and pull apart rather than coming away from each digit
VST	Very sticky	Soil material adheres strongly to thumb and finger after release of pressure, and stretches when fingers are separated

Plasticity: Plasticity is the ability of soil material to change shape continuously under the influence of an applied stress and to retain the compressed shape on removal of stress.determined by rolling the soil in the hands until a wire about 3 mm in diameter has been formed (FAO, 2006) (Table 41).

Table 41: Classification of soil plasticity

Code	Definition	Description
NPL	Non-plastic	No wire is formable
SPL	Slightly plastic	Wire formable but breaks immediately if bent into a ring; deformation by slight force
PL	Plastic	Wire formable but breaks if bent into a ring; deformation by slight to moderate force
VPL	Very plastic	Wire formable and can be bent into a ring; deformation by moderately strong to strong force

Kostea

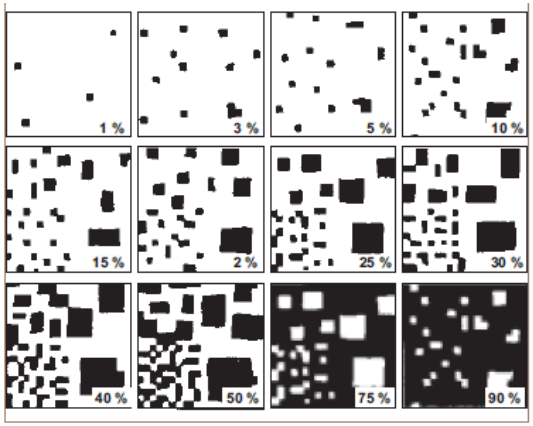
Märkä

Muovattavuus/tahmeus

(Irish Soil Information System: Soil Profile handbook, 2008)

Läpäisevyyden tuntomerkkejä:

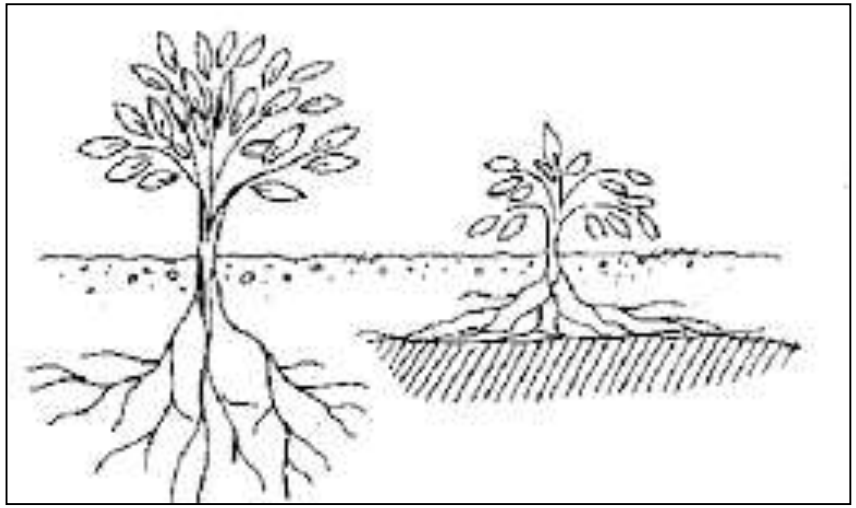
- Kivisyys
- Maan osasten suuntautuneisuus (vaaka/pysty)

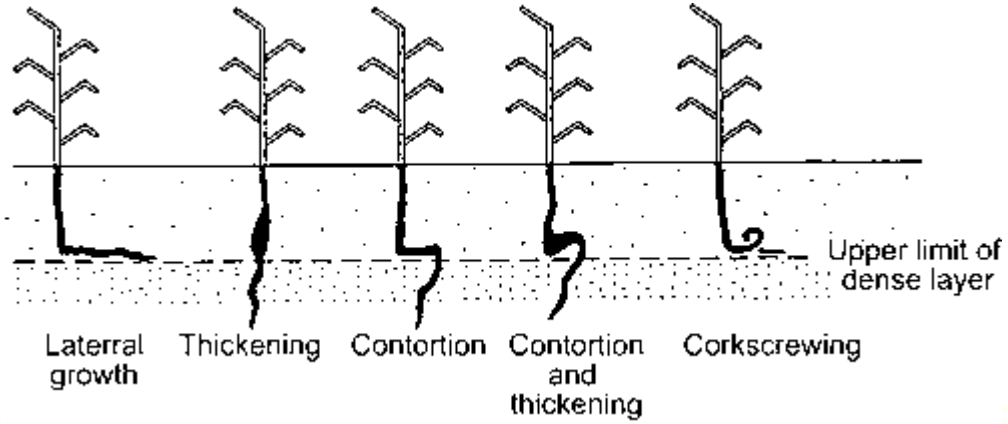


(FAO, 2006)

Läpäisevyyden tuntomerkkejä:

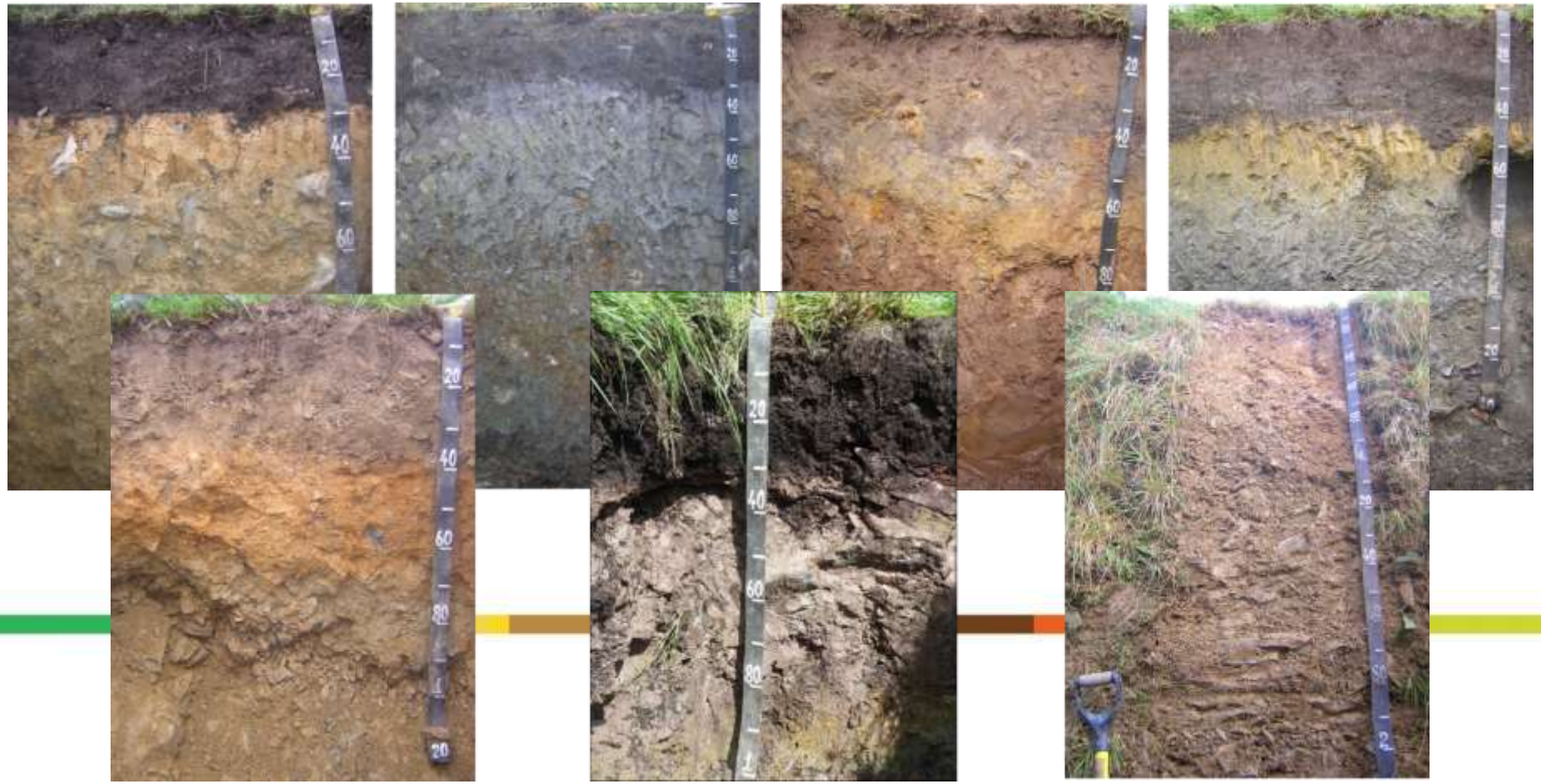
- Juurten kasvu, suunta, syvyys





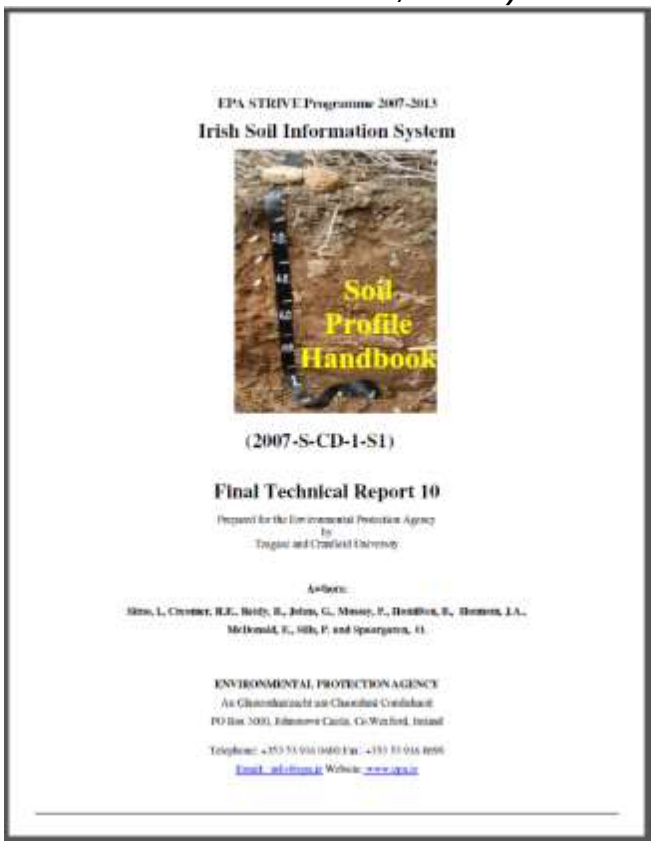
Läpäisevyyden tuntomerkkejä:

- Väri:
  - Ruskeat sävyt: hyvä rakenne, vähän kuivatusongelmia
  - Sininen/harmaa: raskas, veden vaivaama, korkea pohjavesi
  - Musta: paljon multavuutta
  - Valkoinen/vaalea: huuhtoutunut



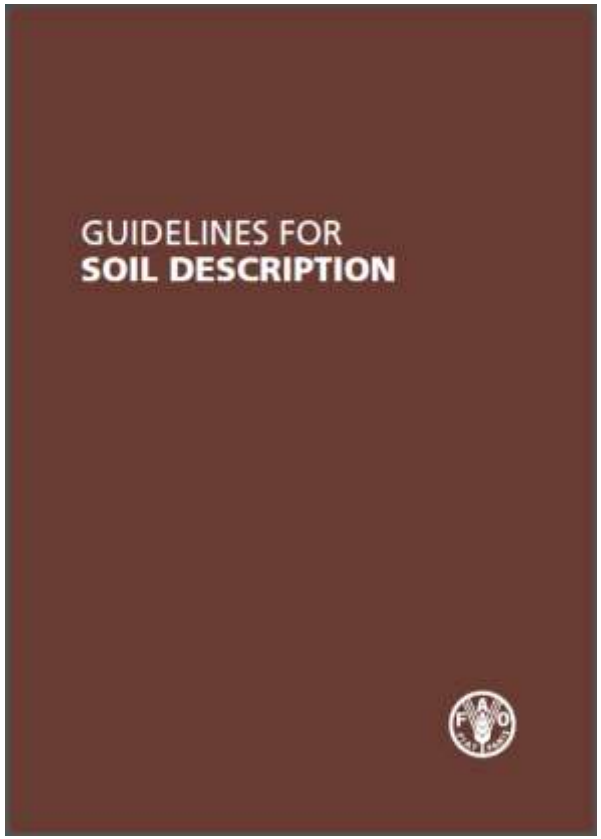
Tarkemmin oppaista:

(Irish Soil Information System:
Soil Profile Handbook, 2008)



http://gis.teagasc.ie/soils/downloads.php
→Project Technical Reports

(FAO, Guidelines for Soil Description 2006)

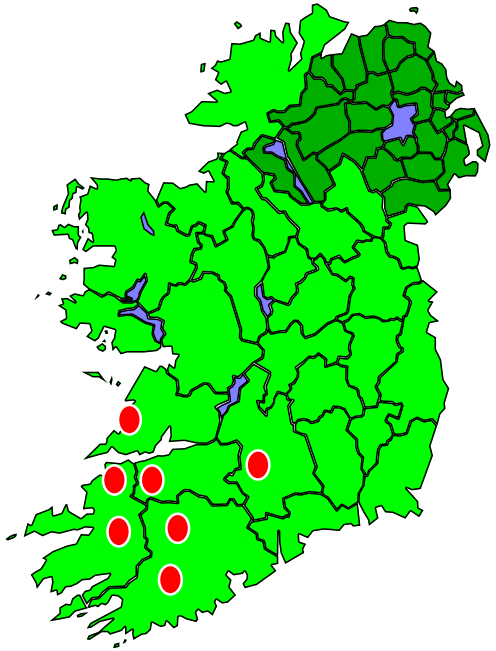


http://www.fao.org/publications/card/en/c/903943c7-f56a-521a-8d32-459e7e0cdae9/

Kuivatustilan arviointi - yksityiskohdat

- **Tuntomerkit**

Veden tihkuminen
Tiiviit kerrokset
Maalaji (hieta, hiesu, savi)
Huokoset
Koostumus
Kivisyys
Juuret



Maan jako kerroksiin

- **Eri kerrokset erotetaan tuntomerkkien avulla**
- **Kerrosten luokittelu hyvin, kohtalaisesti ja heikosti läpäiseviin**
- **Lohkokohtainen kuivatussuunnitelma luokittelun perusteella**

Tuntomerkkien pisteytys

Tuntomerkki	Luokittelu	Luokittelu	Pisteet	Painotus
Veden tihkuminen	Kyllä/ei	• Vettä tihkuu	1	A
		• Ei tihku	0	
Tiivistymät	Kyllä/ei	• Tiivis kerros	-1	A
		• Ei tiivistynyt	0	
Maalaji	Aistinvarainen luokitus (DEFRA 2005)	• Kevyet ja keskiraskaat maat	1	B
		• Raskaat savimaat	0	
Huokoset	Vähän, kohtalaisesti tai paljon (Shepherd 2009)	• Paljon	2	C
		• Kohtalaisesti	1	
		• Vähän	0	
Koostumus	Tahmeus & muovailtavuus (FAO 2006)	• Ei-tahmea, ei muovailtava	2	C
		• Tahmea tai muovailtava	1	
		• Tahmea ja muovailtava	0	
Kivisyys	Kivien määrä (FAO 2006)	• Kiviä > 15%	1	C
		• Kiviä < 15%	0	
Juuret	Kyllä/ei	• Juuria	1	C
		• Ei juuria	0	

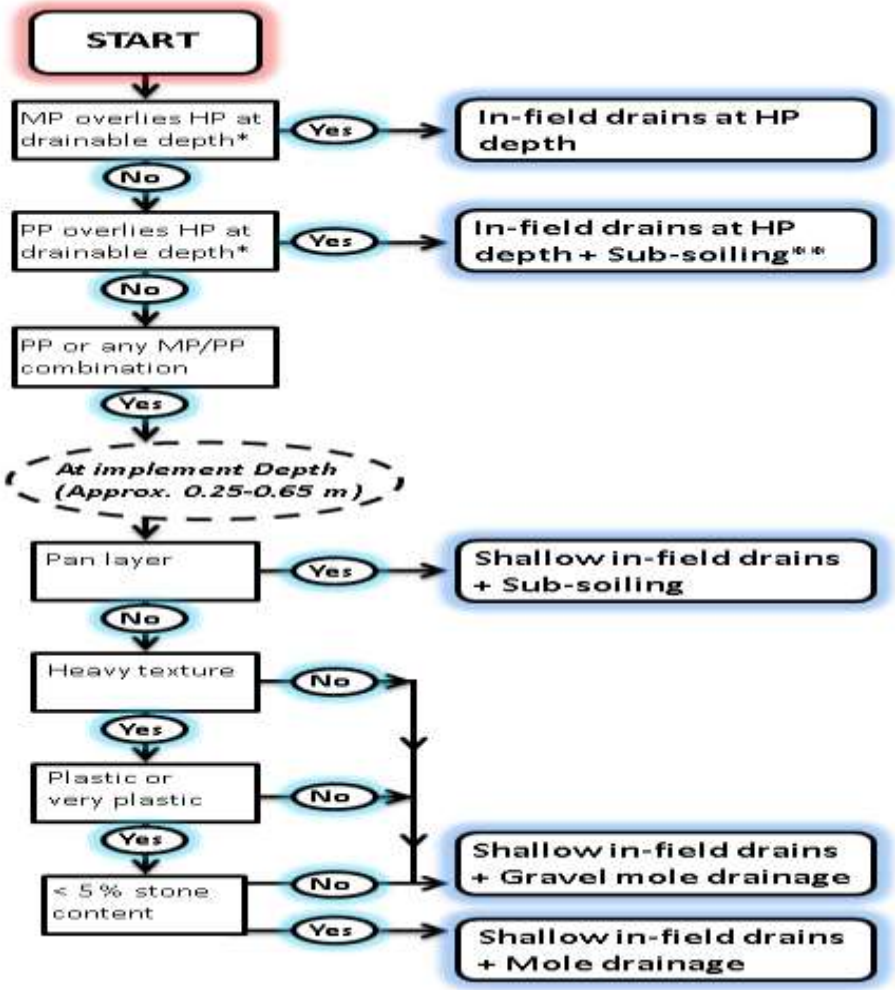
(A =10, B = 4, C = 1)

Tuntomerkkien pisteytys

Table 3. Classification of each indicator for each soil horizon and site including visual drainage assessment (VDA) score (S), weighted score (WS) and VDA total score and permeability classification. Poorly permeable horizons have a VDA score ≤ 5, moderately permeable horizons have a VDA score > 5 and ≤ 10 and highly permeable soils have a VDA score >10

Site	Horizons (m)	Water seepage	S	WS	Pan	S	WS	Texture	S	WS	Porosity	S	WS	Consistence	S	WS	Stone content	S	WS	Roots	S	WS	VDA total score	Classification
Rossmore	0.0–0.2	No	0	0	No	0	0	Medium	1	4	Good	2	2	Slightly sticky, non-plastic	1	1	Few (2–5%)	0	0	Yes	1	1	8	Moderately Permeable
	0.2–0.4	No	0	0	No	0	0	Medium	1	4	Poor	0	0	Slightly sticky, non-plastic	1	1	None	0	0	Yes	1	1	6	Moderately Permeable
	0.4–1.3	No	0	0	No	0	0	Medium	1	4	Moderate	1	1	Non-sticky, non-plastic	2	2	Few (2–5%)	0	0	No	0	0	7	Moderately Permeable
	1.3–2.5	Yes	1	10	No	0	0	Medium	1	4	Good	2	2	Non-sticky, non-plastic	2	2	None	0	0	No	0	0	18	Highly Permeable
Castleis-land	0.0–0.3	No	0	0	No	0	0	Medium	1	4	Good	2	2	Slightly sticky, non-plastic	1	1	Few (2–5%)	0	0	Yes	1	1	8	Moderately Permeable
	0.3–0.9	No	0	0	No	0	0	Heavy	0	0	Poor	0	0	Sticky, slightly plastic	0	0	Many (15–40%)	1	1	No	0	0	1	Poorly Permeable
	0.9–3.6	No	0	0	No	0	0	Heavy	0	0	Poor	1	1	Sticky, slightly plastic	0	0	Many (15–40%)	1	1	No	0	0	2	Poorly Permeable

Note: Texture is estimated by adapting the methods of DEFRA (2005), Stone content and consistence are described using the classifications of FAO (2006) and porosity is described using the classifications of Shepherd (2009).



Kehitimme vuokaavion menetelmän soveltamiseen pellolla:

Completed by:_____ Date:_____

Farm:_____Field/Paddock:_____Test Pit No.:___

GROUNDWATER SEEPAGE: Present: YES NO

Depth of groundwater seepage into pit: _____m _____m

TEXTURE GROUP (DEFRA, 2005):

IF PEATY/ORGANIC DESCRIBE AS PEAT

OTHERWISE take MINERAL soil sample, remove any stones, if dry, wet up gradually, kneading between finger and thumb until soil crumbs are broken down. FOLLOW FLOW CHART to get Texture group

- Is the moist soil predominantly ROUGH and GRITTY? YES → Light soils
- NO → Does soil mould to form an easily deformed ball and feel SMOOTH and SILKY? YES → Light soils
- NO → Does soil mould to form a strong ball which DOES NOT TAKE A POLISH? YES → Medium soils
- NO → Soil moulds like PLASTICINE, POLISHES and feels VERY STICKY when wet YES → Heavy soils

Depth range: _____ _____ _____ _____

Texture group:_____ _____ _____ _____

Pan/Cemented LAYERS: Present: YES NO

Depth range(s): _____m _____m

ROOTS/ MOTTLES/STONES:

Depth range: _____ _____ _____

Rooting (Y or N): _____ _____ _____

% Stone content:_____ _____ _____

Mottles (Y or N): _____ _____ _____

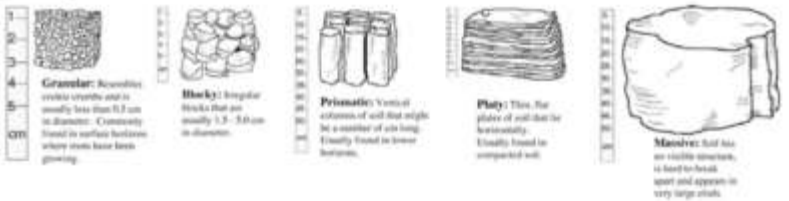
Correspondence: patrick.tuohy@teagasc.ie

STRUCTURE (FAO, 2006) **& POROSITY** (Shepherd, 2009):

GRADE: **Aggregates are "clumps" of soil particles that are bound together**

Weak	Aggregates are barely observable
Moderate	Aggregates are observable
Strong	Aggregates are clearly observable

TYPE:



Depth range: _____ _____ _____ _____

Grade: _____ _____ _____ _____

Type: _____ _____ _____ _____

Good: Soils have many macropores between and within aggregates

Moderate: Macropores are fewer but are present on close examination

Poor: No visible macropores, massive structureless smooth surfaced, sharp edges

Porosity: _____ _____ _____ _____

PLASTICITY (FAO, 2006):

Roll the soil in the hands to form a wire about 3 mm in diameter (RED LINE IS 3 mm)

Non-plastic	No wire is formable
Slightly-plastic	Wire formable but breaks immediately if bent
Plastic	Wire formable but breaks if bent into a ring
Very plastic	Wire formable and can be bent into a ring

Plasticity: _____ _____ _____ _____

SOME TYPICAL CHARACTERISTICS

A soil layer may not comply with all of these characteristics the aim is to PICK THE MOST APPROPRIATE CATEGORY for a particular depth range

RED TEXT ITEMS ARE TELLTALE SIGNS IN EITHER CASE, but do not necessarily have to be present for a soil layer to fit that category

Highly permeable (HP)
- Ground water seepage
- Medium/light texture
- Strong granular, blocky or prismatic structure
- Good porosity
- Non-plastic

Poorly permeable (PP)
- Pan layer
- Heavy texture
- Massive or platy structure
- Poor porosity
- Poor root development
- Plastic
- Mottled

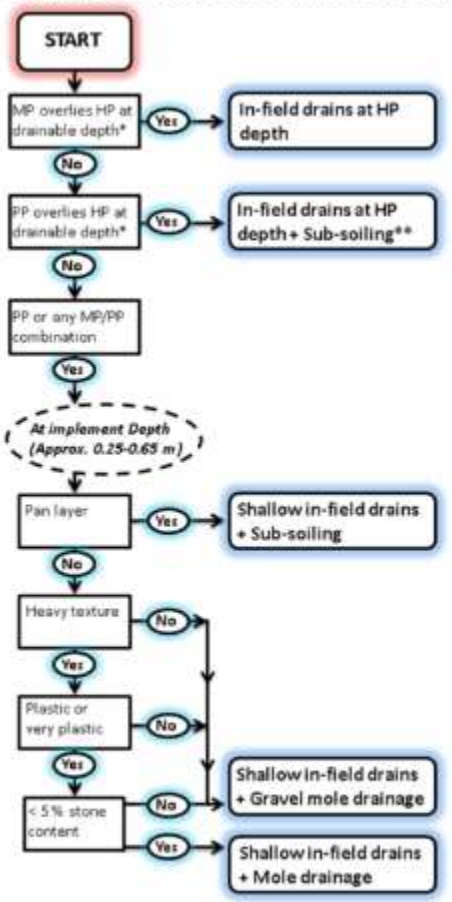
Moderately permeable (MP)

Intermediate between HP and PP
- Medium/light texture
- Moderate grade structure
- Moderate porosity
- Non-plastic
- May be mottled

	Permeability Class (TICK to specify)		
Depth Range (m)	Poor	Moderate	High

AFTER completing page 1-3 and DEFINING PERMEABILITY CLASS

Drainage SYSTEM TYPE Decision Support



The most appropriate drainage system type for this site is:

_____

_____

Jako kolmeen luokkaan

Eri ominaisuuksille annetaan pisteitä ja painokertoimien avulla eri ominaisuuksia painotetaan eri tavoin.

Jokainen kerros arvioidaan erikseen. Poimi tyypillisimmät ominaisuudet, jos jokin kerroksen ominaisuuksista ei sovi alla olevaan kolmijakoon.

Punaiset kohdat ovat tärkeimpiä tuntomerkkejä, mutta niitä ei välttämättä esiinny kaikissa maissa.

Hyvä vedenläpäisykyky

-Pohjaveden korkeus
-Kevyt tai keskiraskas maalaji
-Hyvin murustunut, kokkareiden tai särmikäs rakenne
-Ei muovailtava

Huono vedenläpäisykyky

-Tiivistyneitä kerroksia
-Raskas maalaji
-Massiivinen tai kerroksellinen rakenne
-Vähän huokosia
-Muovailtava
-Laikukas

Keskinkertainen vedenläpäisykyky

-Keskiraskas tai kevyt maalaji
-Keskinkertaisesti muruinen rakenne
-Kohtuullisesti huokosia
-Ei muovailtava
-Saattaa olla laikkkuja