OSMO
OSAAMISTA MAAN KASVUKUNNON HOITOON

# How to identify problems with soil health and how to manage the field?

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Euroopan maaseudun kehittämisen maatalousrahasto: Eurooppa investoi maaseutualueisiin
Elinkeino-, liikenne- ja ympäristökeskus
Agria
Helsingin yliopisto Ruralia-instituutti
eurofins Viljavuuspalvelu
ecovin
SOIL FOOD
Rikalan Säätiö
Luonnonmukaisen tuotannon edistämissäätiö

# Important resources in agriculture

- Knowhow of Farmers
- Soil Health

**=>**OSMO- Knowhow and tools for resource-efficient soil health management in a collaborative network -project 2015-2019

https://www.helsinki.fi/fi/ruralia-instituutti/koulutus/maan-kasvukunto/osmo-a-collaborative-network-testing-knowledge-and-tools-for-resource-efficient-soil-health-management

# OSMO
# -Collaborative project at four provinces
2015-2019

Centre for Economic Development, Transport and the Environment in Southwest Finland (Rural Development Programme for Mainland Finland 2014-2020 / Special Funding for Water Protection and Nutrient Recycling)

## Actors:

University of Helsinki, Ruralia Institute

Rural Advisory Services ProAgria
(Southwestern Finland and South Bothnia regions)

## Activity provinces at West- and South cost:

South Ostrabothnia, Satakunta Region, South-West Finland and Uusimaa Region

## Funding:

Centre for Economic Development, Transport and the Environment in Southwest Finland, companies, farmers and foundations

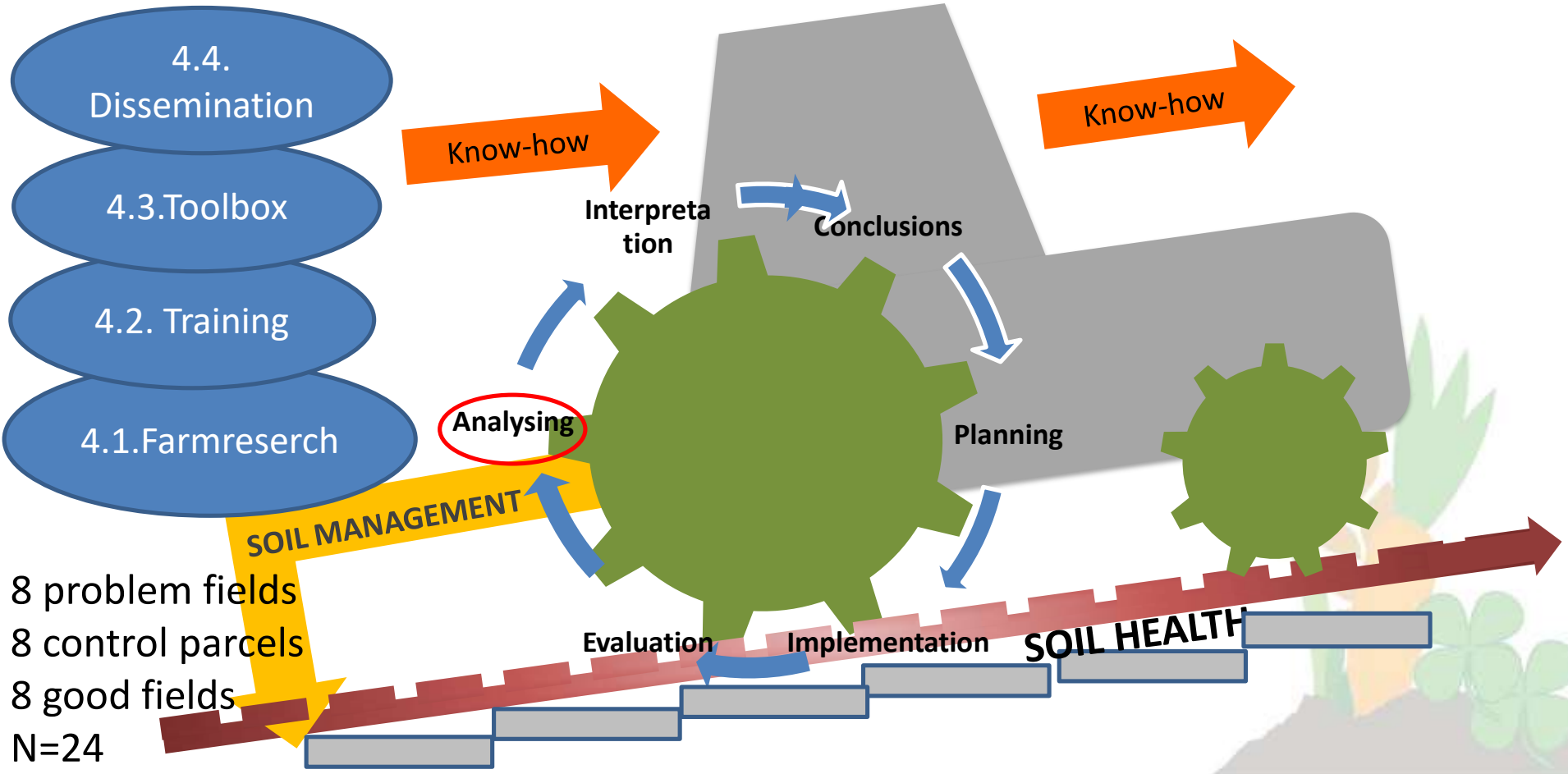
# Objectives

- The main objective of the project was to **increase resource efficiency** in agriculture by managing the soil and its growth potential holistically.
  Sub-objectives:
  - **Improve methods for testing soil quality and health**
  - **Improve farmers' know-how in soil health management**
  - **Develop practical tools and study materials** for planning, implementing and evaluating soil health management at farml evel
  - **Inform the general public** about soil health and its management.

# Questions to be answered

- What´s wrong in poor growing fields?
- How to assess it?
- Why?
- What can be done to fix this?
- Does it work?
- Does it pay?

# Objectives and Project work packages

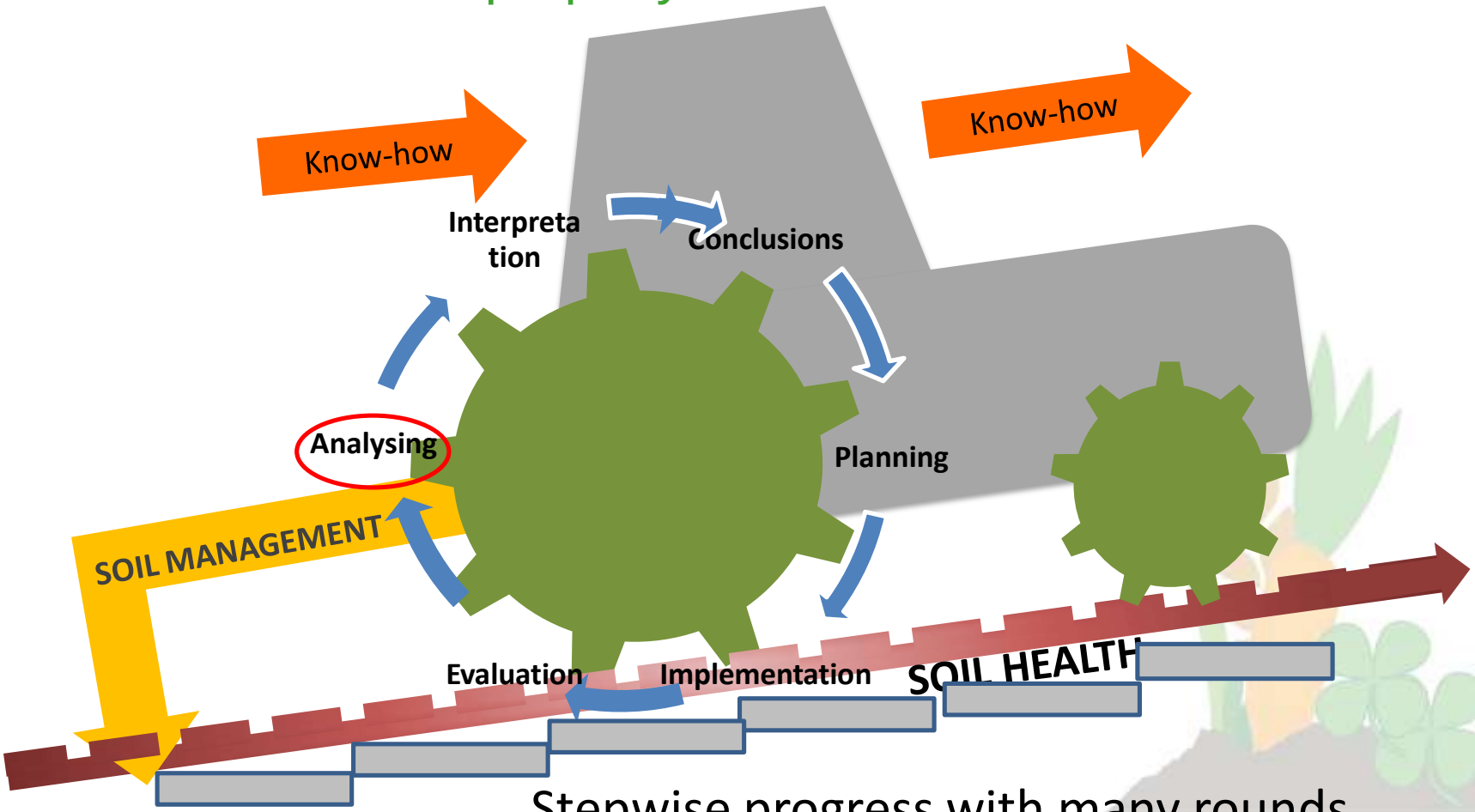



8 problem fields
8 control parcels
8 good fields
N=24

Many methods tested to assess the soil health at farm level

# Soil health developing wheel

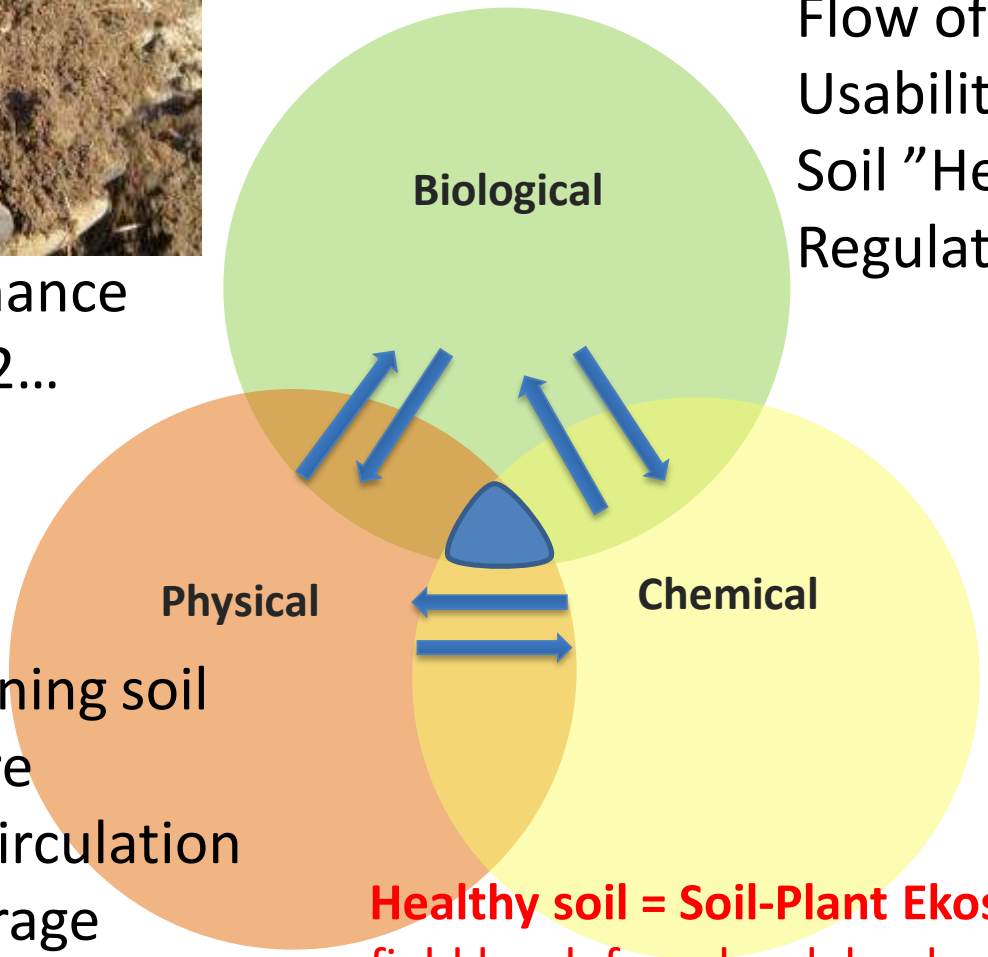
## Systematic developing starts from monitoring the field properly




Stepwise progress with many rounds

# Holistic view of Soil Health

Gas Exhance
O2, CO2…




Flow of energy /carbon
Usability of nutrients
Soil ”Health”
Regulation of soil functions

Maintaining soil structure
Water circulation and storage

Nutrient storage and circulation

**Healthy soil = Soil-Plant Ekosystem is functioning well**
field level, farm level, landscape level and social level

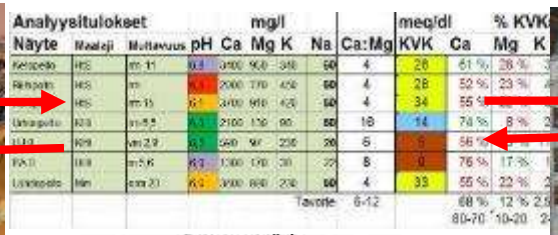
# Project model - interactions

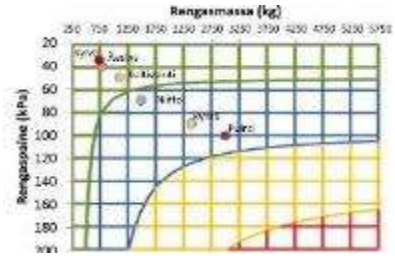
Farm research

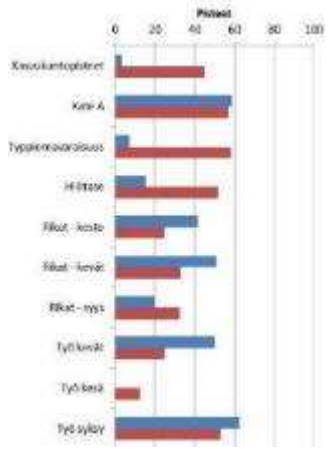
Training

Toolbox

Dissemination








Europan maaseudun kehittämisen maatalousrahasto: Europa investoi maaseutualueisiin

Elinkeino-, liikenne- ja ympäristökeskus

Agria

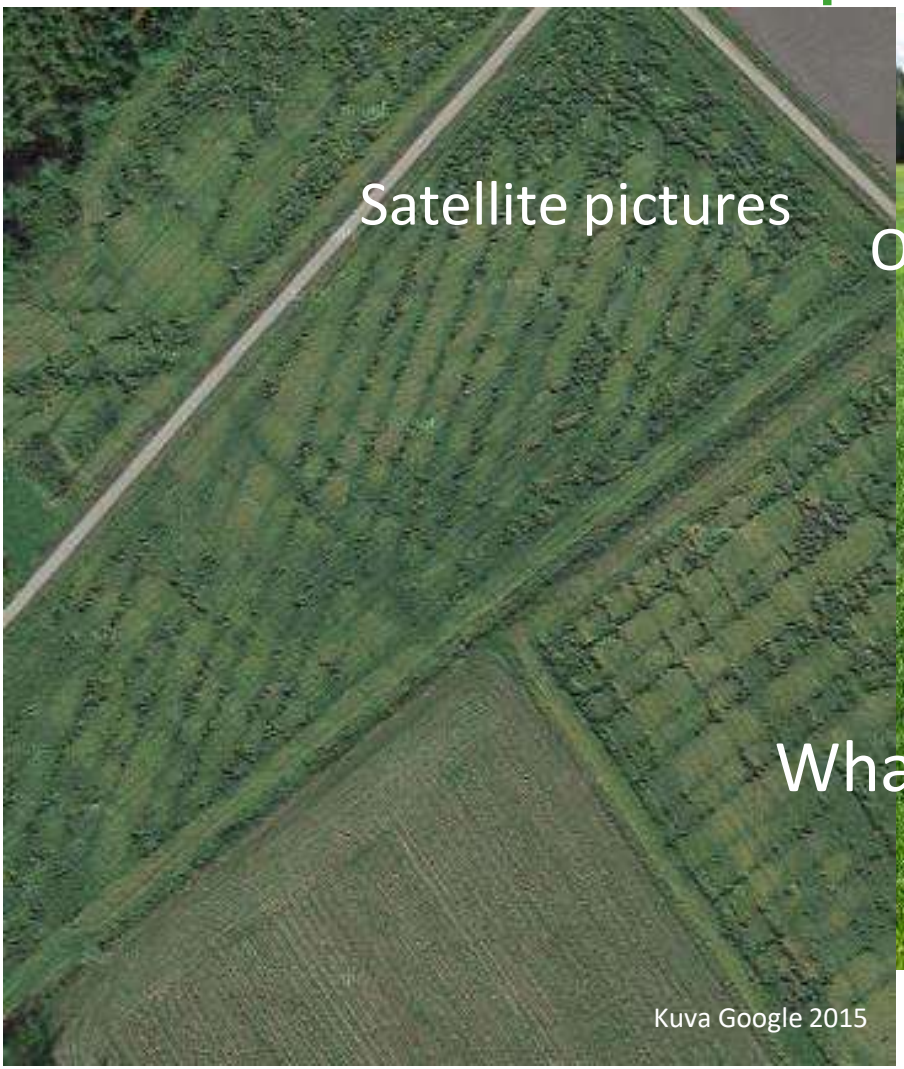
HELSINGIN YLIOPISTO

# How to identify soil health at farm level –in OSMO-project?

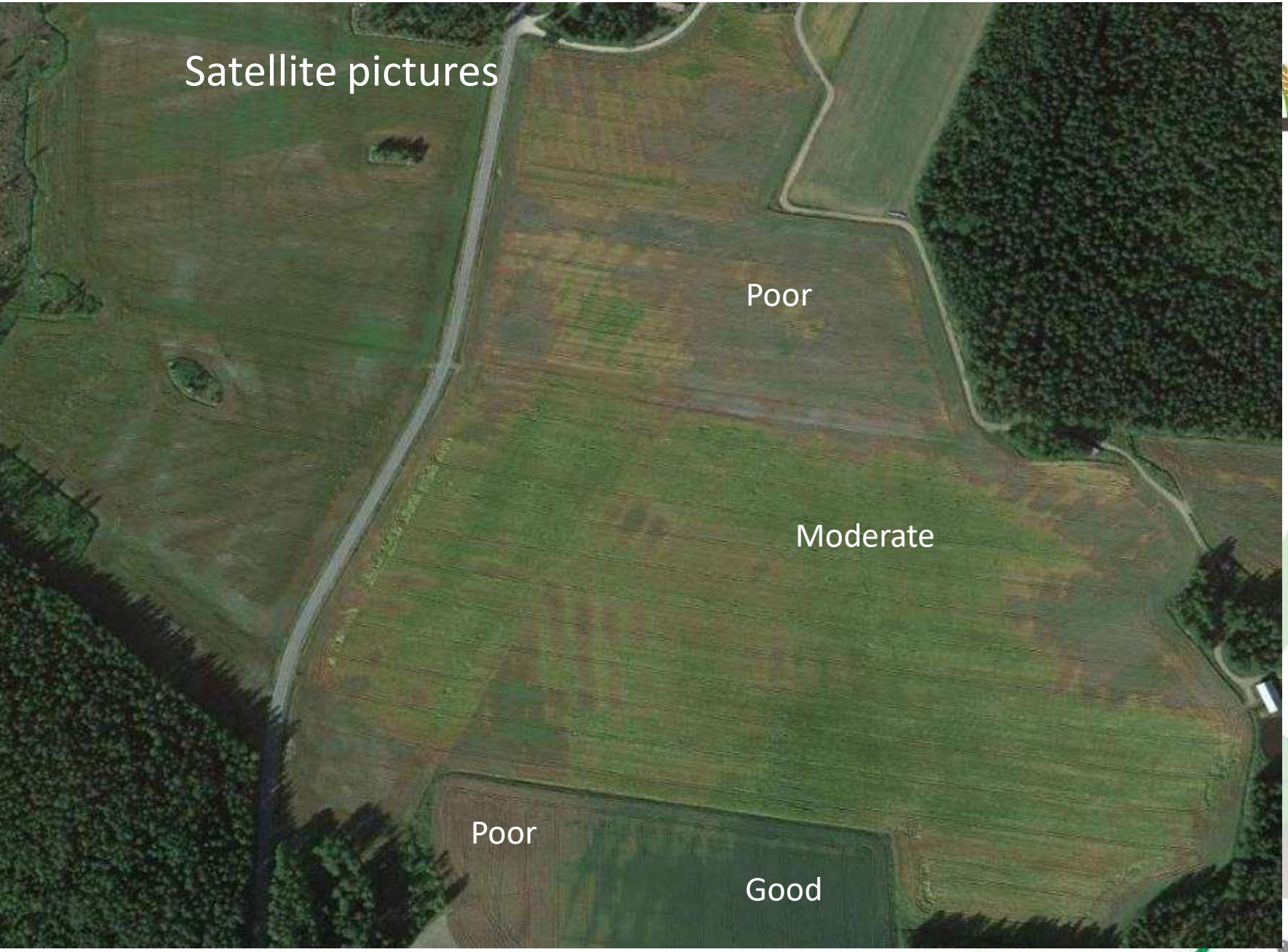
- Physical
  Satellite photos, sensory, VESS, penetrometer, status of drainage, goundwater level (spade pit), infiltration (bottle-test, pantest), compaction risk tool, Terranimo.world
- Chemical
  Five chemical analysis, wide variety of properties; Spurway, Haney Test, Ammoniumasetate, Meh3, HCl
- Biological
  Root growth; visual evaluation
  Earthworms; Senfwater, Counting from spade, checking worm channels in the top of subsoil
  Biol activity; Soil health, Solvita CO2-purst, N-mineralisation
  Water Stable Aggregates; Hole plate, VAST Stable aggregates in %, Teesieve-test

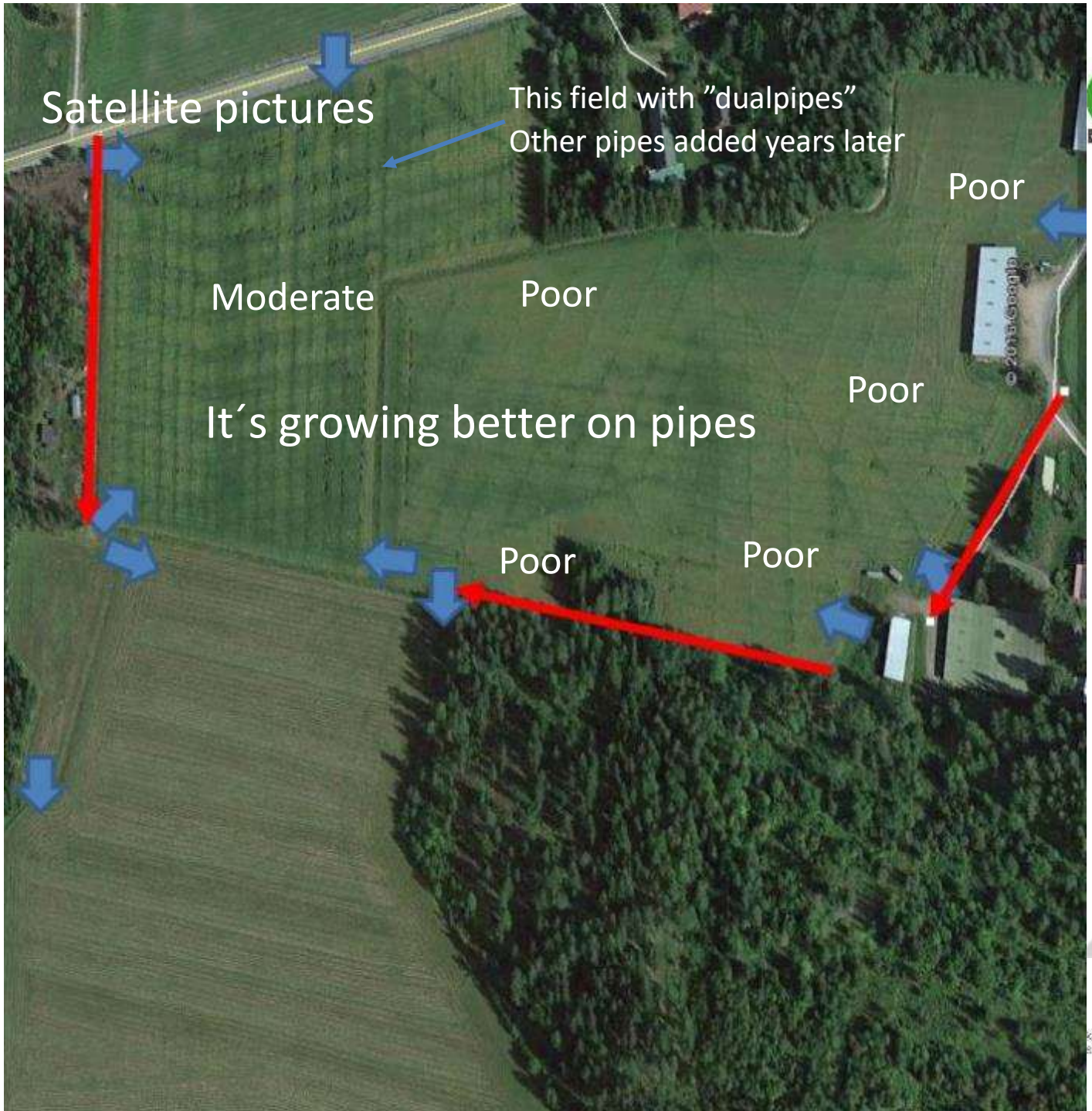
# Overview; Satellite pictures, Soil health

# Overview;
# -Where are problems?




# Satellite pictures




Satellite pictures
This field with ”dualpipes”
Other pipes added years later
Poor
Moderate
Poor
Poor
It´s growing better on pipes
Poor
Poor

# Visual observations;
## - Crop performance, Water ponds



# Differences in Soil structure – Clay soils

Kuvat: Jukka Rajala

# Differences in Soil structure – Sandy soils

Kuvat: Jukka Rajala

# Visual soil assesment VESS/MARA

| Structure quality | Size and appearance of aggregates | Visible porosity and Roots | Appearance after break-up: various soils | Appearance after break-up: same soil different tillage | Distinguishing feature | Appearance and description of natural or reduced fragment of ~ 1.5 cm diameter |
|---|---|---|---|---|---|---|
| **Sq1 Friable**<br>Aggregates readily crumble with fingers | Mostly < 6 mm after crumbling | Highly porous<br>Roots throughout the soil |  |  |  <br>Fine aggregates |  <br>The action of breaking the block is enough to reveal them. Large aggregates are composed of smaller ones, held by roots. |
| **Sq2 Intact**<br>Aggregates easy to break with one hand | A mixture of porous, rounded aggregates from 2mm - 7 cm. No clods present | Most aggregates are porous<br>Roots throughout the soil |  |  |  <br>High aggregate porosity |  <br>Aggregates when obtained are rounded, very fragile, crumble very easily and are highly porous. |
| **Sq3 Firm**<br>Most aggregates break with one hand | A mixture of porous aggregates from 2mm -10 cm; less than 30% are <1 cm. Some angular, non-porous aggregates (clods) may be present | Macropores and cracks present.<br>Porosity and roots both within aggregates. |  |  |  <br>Low aggregate porosity |  <br>Aggregate fragments are fairly easy to obtain. They have few visible pores and are rounded. Roots usually grow through the aggregates. |
| **Sq4 Compact**<br>Requires considerable effort to break aggregates with one hand | Mostly large > 10 cm and sub-angular non-porous; horizontal/platy also possible; less than 30% are <7 cm | Few macropores and cracks<br>All roots are clustered in macropores and around aggregates |  |  |  <br>Distinct macropores |  <br>Aggregate fragments are easy to obtain when soil is wet, in cube shapes which are very sharp-edged and show cracks internally. |
| **Sq5 Very compact**<br>Difficult to break up | Mostly large > 10 cm, very few < 7 cm, angular and non-porous | Very low porosity. Macropores may be present. May contain anaerobic zones.<br>Few roots, if any, and restricted to cracks |  |  |  <br>Grey-blue colour |  <br>Aggregate fragments are easy to obtain when soil is wet, although considerable force may be needed. No pores or cracks are visible usually. |




[Verktyg för visuell bedömning av markstrukturen - Markstrukturkort (2021)]

# Structure 8.2019 MARA


- Loamy Clay, ley 1
- 

| cm | Points | |
|---|---|---|
| 8 | 3 | Moderate |
| 10 | 2 | Poor |
| 6 | 2 | Poor |
| 24 | 2,33 | In avarage |

- =>Structure have to improved

# Physical Fertility – Methods for assessment

- Satellite/drone photos
  -where to evaluate more briefly
- Spade pit
  -groundwater level
- Digger pit
  -structure of subsoil









Photos: Jukka Rajala and Google Earth

# Physical Fertility
# - Methods for assesment

- Spade diagnosis VESS /MARA
  -Soil structure
- Penetrometer/Soil sonde
  -Compacted layers
- Bottletest
  -Infiltration of soil surface
- Pantest
  -Infiltration of topsoil/ subsoil
- Crumb hardness
  -sensitivity to silting up
  -Hole plate, VAST
  Stable aggregates in %
  Tee-sieve-test






Photos: Jukka Rajala, Jaana Ravander

# Infiltration of water

**Testmethod**

**Where the water lows? How fast? How much?**





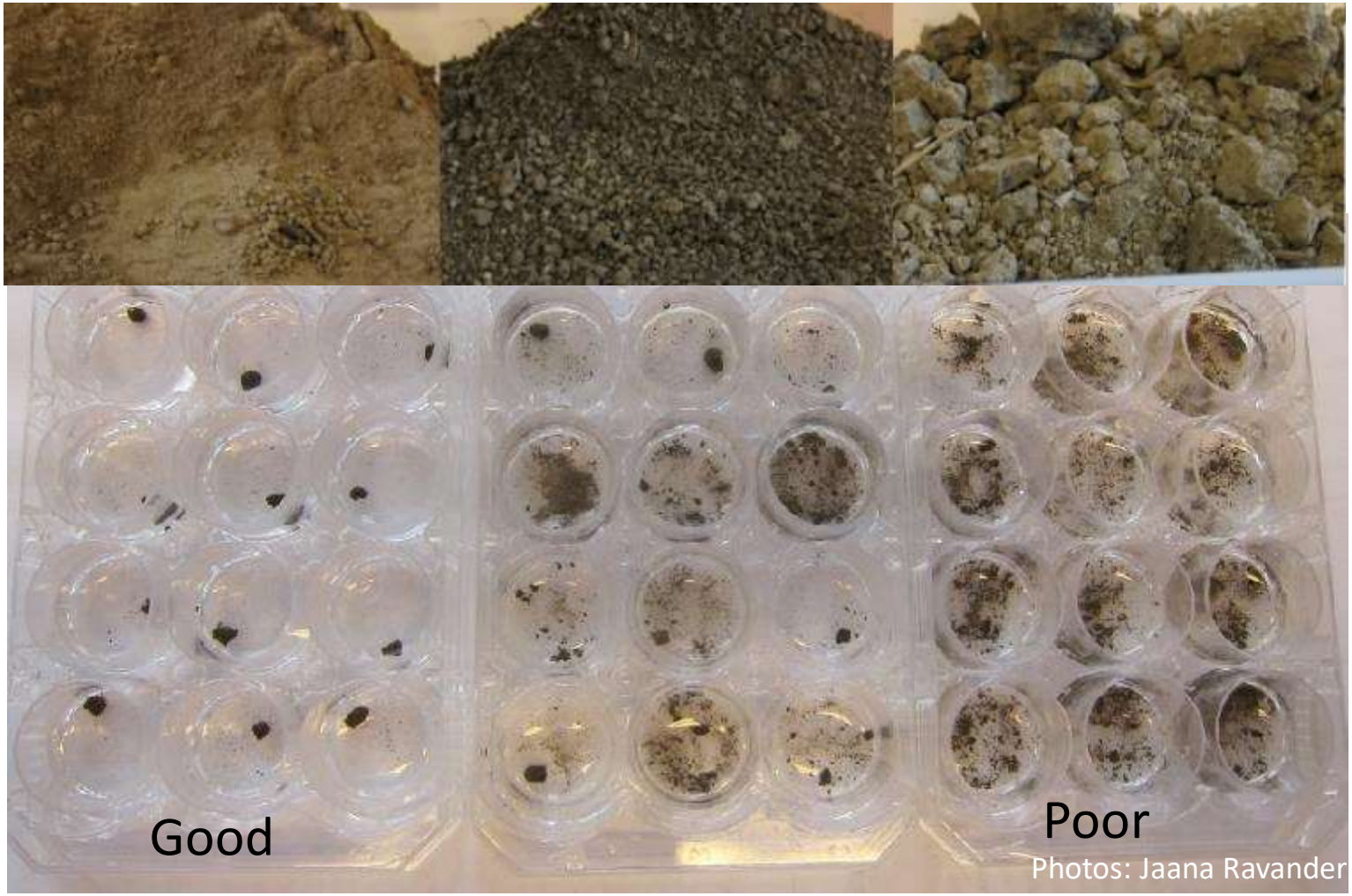

Photos Jukka Rajala

# Slaketest


Good structure
Sample from the side of the same field

Poor structure
Sample from the field

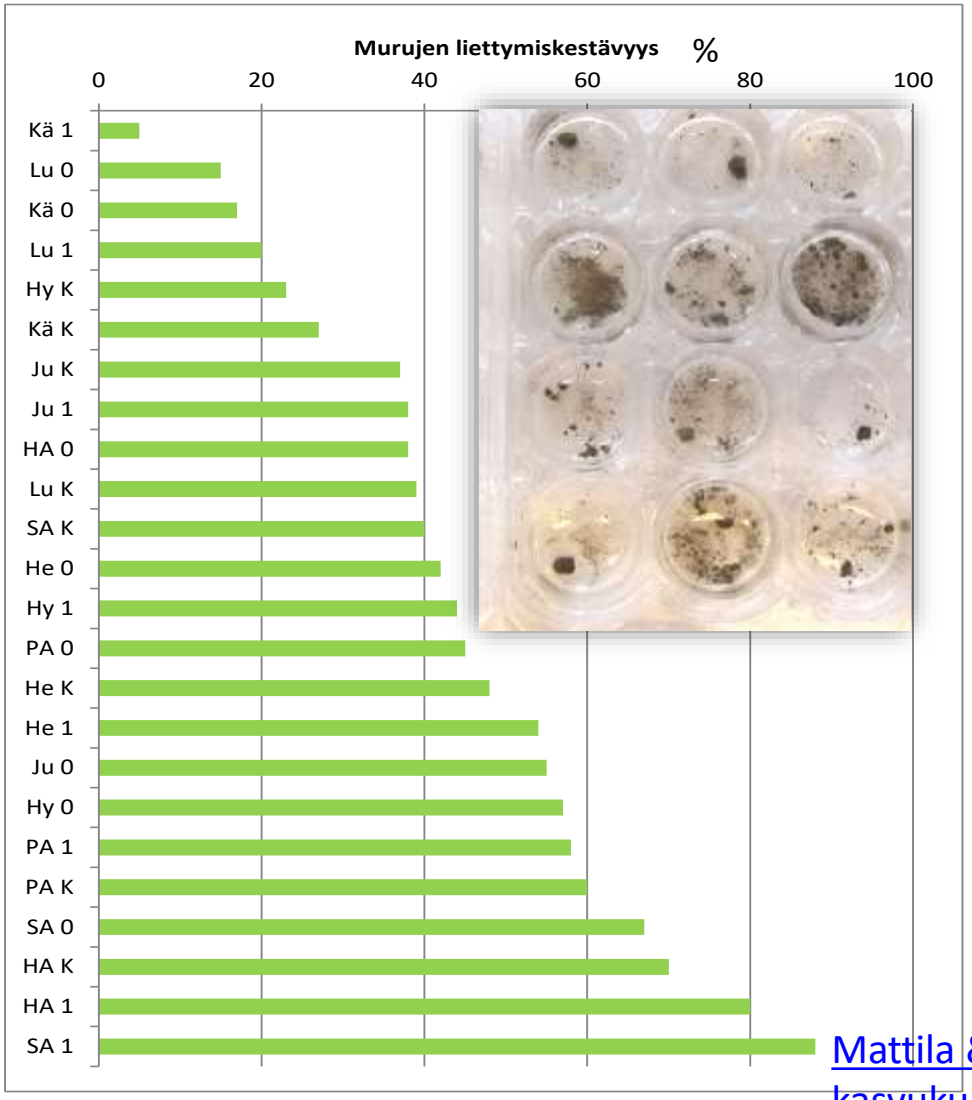
# Crumb water hardness test




With fresh crumbs. Possible to do on the field.

https://aoe.fi/#/materiaali/1136 > Choose sv to get Faktablad in Svedish

# Crumb water hardiness test

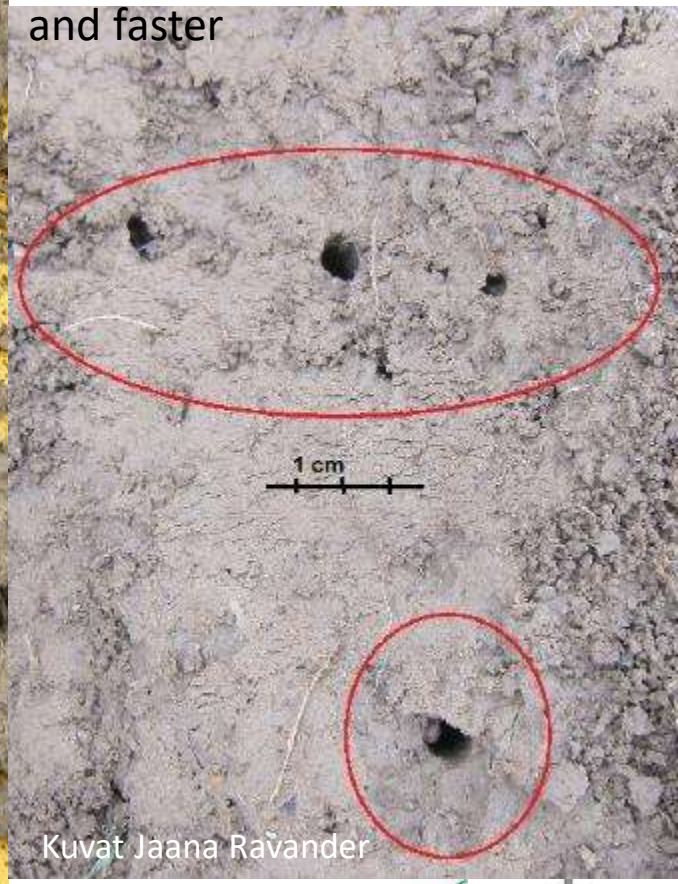



- Higher values for clay soils, but some sandy soils also
- Big differences between fields

Mattila & Rajala, 2017. Mistä ja miten tunnistaa maan hyvän kasvukunnon? HY Ruralia. Raportteja 171.

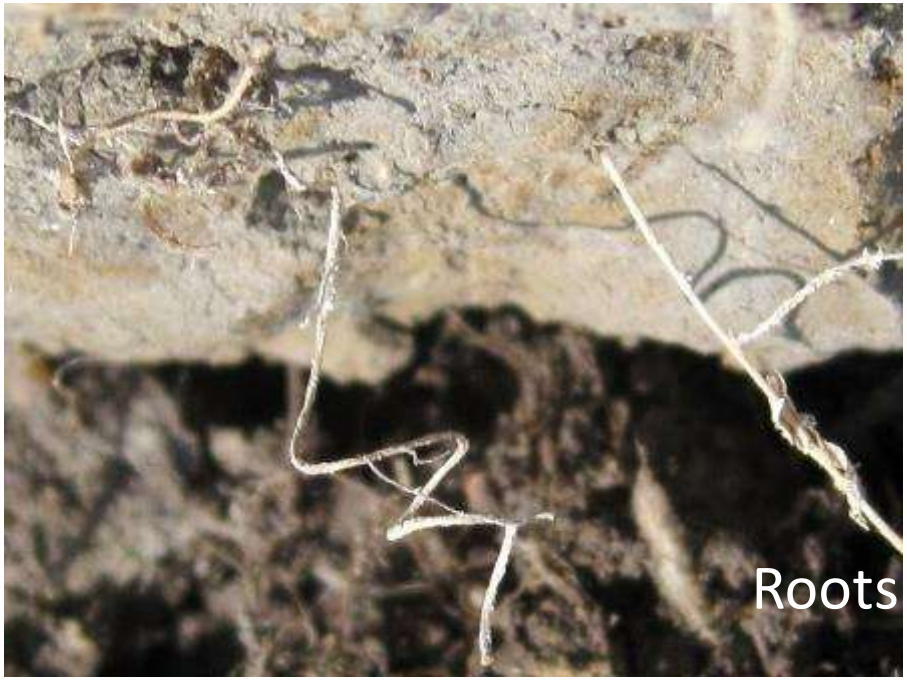
# Biol activity – Earthworm channels

Counting earthworms in spadeblock+channels in subsoil =about Senf-test, but simpler and faster




Kuvat Jaana Ravander

# Roots – Mirror of soil structure

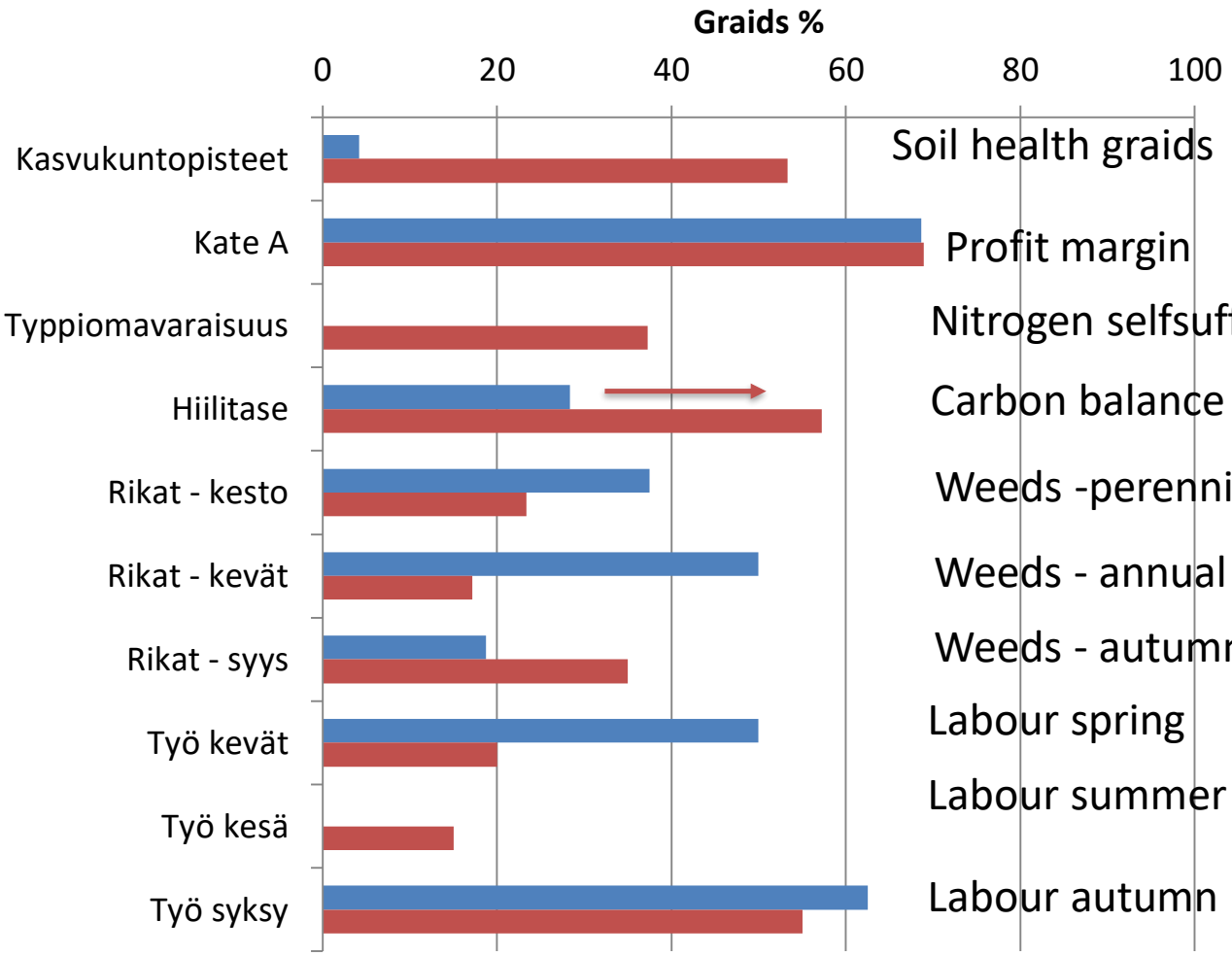


Very poor root growth and activity


Good root growth and activity

# Roots – mirror of soil structure


# Crop rotation for soil health




Soil health graids

OSMO-Tool to compare 2 rotations + counting Green weeks

Profit margin

Nitrogen selfsufficiency

Carbon balance

Weeds -perennial

Weeds - annual

Weeds - autumn

Labour spring

Labour summer

Labour autumn

Rotation 1: Barley-Oat-Summerwheat-Summerrape; covercrops 25 %

Rotation 2: Oat-Barley+ns-Ley for Greenmanuring-Winterrape-Winterrye; covercrops 40 %

# Use better soil sample analysis -CEC-counter

| Analyysitulokset | | | | mg/l | | | | | cmol/l | % KVKsta | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lohko | Maalaji | Multavuu | pH | Ca | Mg | K | Na | Ca:Mg | KVK | Ca | Mg | K | Na | Muut |
| Luoma | HtMr | vm | 5,6 | 336 | 40 | 75 | 15 | 8 | 3 | 49 % | 10 % | 6 % | 2 % | 33 % |
| Haavisto | HHt | rm | 6,7 | 2280 | 44 | 110 | 15 | 52 | 13 | 86 % | 3 % | 2 % | 0 % | 8 % |
| Joenranta | HeS | rm | 7,0 | 3700 | 890 | 200 | 20 | 4 | 27 | 67 % | 27 % | 2 % | 0 % | 3 % |
| Poikaro | HtS | rm | 6,3 | 4200 | 1200 | 330 | 30 | 4 | 38 | 56 % | 26 % | 2 % | 0 % | 15 % |
| | | | | | | | Tavoite | 6-12 | | 68 % | 12 % | 4 % | 1 % | 15 % |
| Tulkitsija | | | | | | | | | | 60-75 | 10-20 | 2-5 | 0,5-3 | |

CEC
Ca, Mg, K, Na %
Muut = Share of other nutrients %

Ero tavoitetasoon= Need to change in kilos
Kalkitussuositus =Recommended liming

| | | | | Ca | Mg | K | Ca |
|---|---|---|---|---|---|---|---|
| | | | | 33,0% | 8,0% | 3,7% | 26,0% |
| Ero tavoitetasoon | | | | Kalkitussuositus | | | |
| kg/ha | | | | Ca | Mg | K | |
| Ca | Mg | K | Na | Kalsiitti | Dolomiitti | Biotiitti | Kipsi |
| 253 | 18 | -84 | -14 | | | | |
| -959 | 293 | 38 | 31 | | 3,7 | 1,0 | |
| 66 | -989 | 135 | 86 | | | 3,7 | 2,3 |
| 1869 | -1313 | 76 | 114 | 5,7 | | 2,1 | 3,0 |

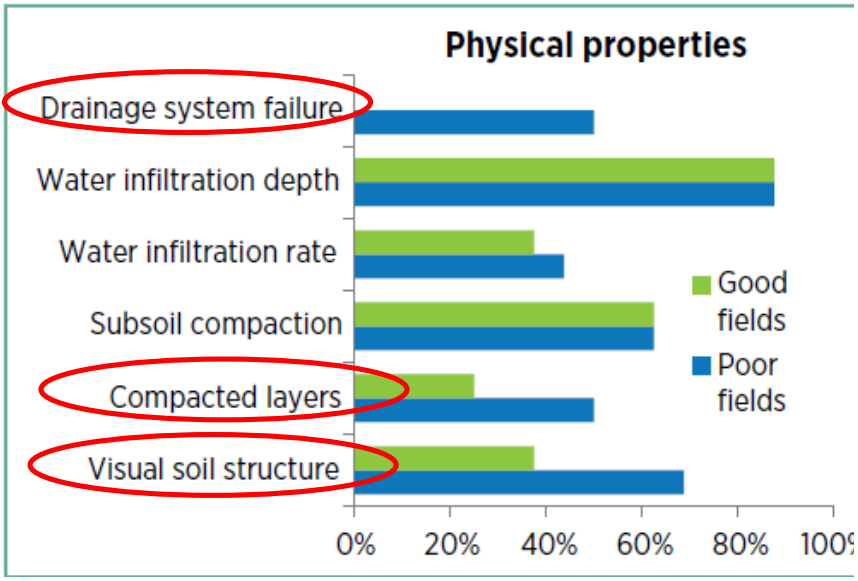
CEC-counter på svenska
https://drive.google.com/file/d/1d9g3eaNKzlyfKP1FmLsEXcnXsmLzqRWq/view

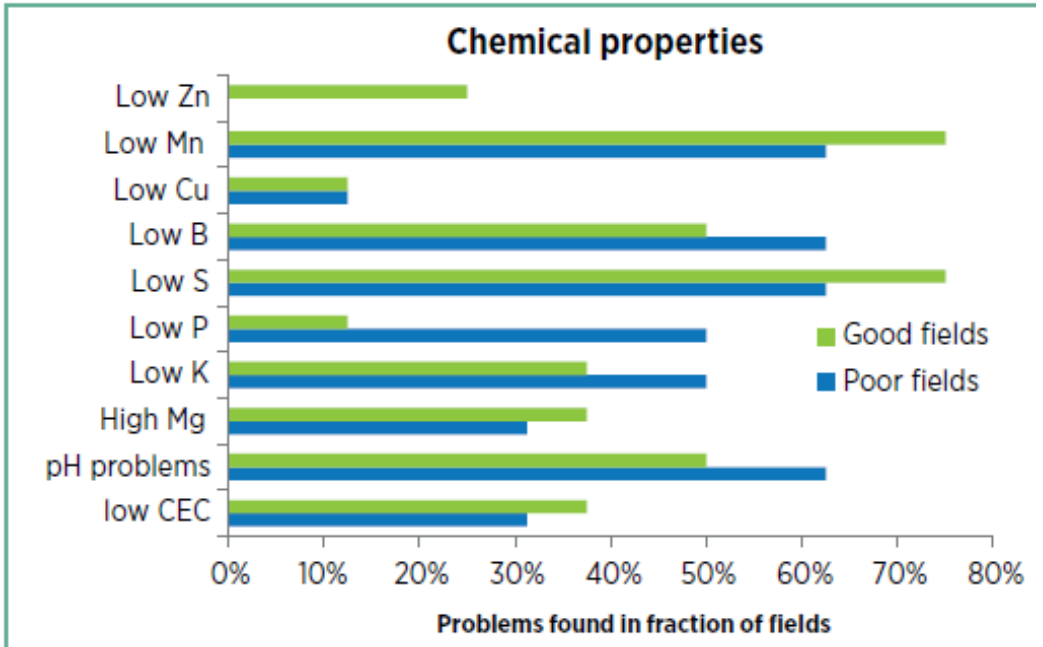
# Common observations of soil health

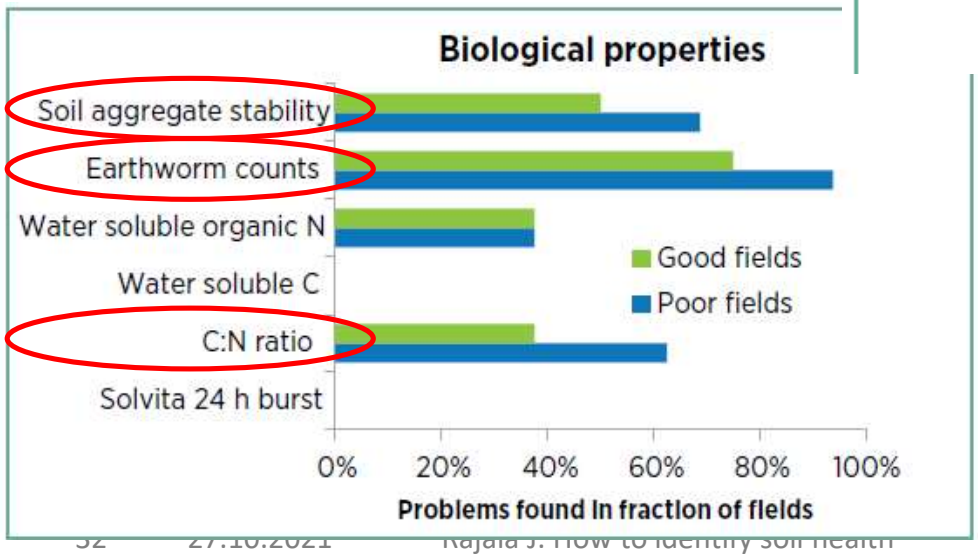
- Drying soil ready for tillage and sowing uniformly
- How easy is the tillage?
- Sprouting eveness
- Sludging and forming of crust
- Water flows on the soil surface and erosion
- Water ponds, infiltration speed
- Sensitiveness to drought and wet periods
- Yield level and variation on the field and between years
- Soil resistance for tillage (plowing, cultivating, subsoiling)
- Photos from air of crop growth and soil drying

# Identifying problems at 8 farms

## OSMO-farmreseach fields 2015




[Mattila ym: Mistä ja miten tunnistaa maan hyvän kasvukunnon? HY, Ruralia-instituutti. Raportteja 171. 2017.]

# Soil health – Set goals

- Physical
  - Drainage and water storage good
  - Soil structure good – no compacting maschinery/works
- Chemical
  - pH moderate/good
  - Nutrient status moderate/good of all nutrients
  - CEC >14
  - Balanced nutrient ratios
- Biological
  - Roots grow dence and deep with good contact to soil
  - Biological activity good
  - SOM content high, about 8-15 % in finnish conditions
  - Crumble hardness good
- =>Interactions of different aspects!

Symptoms vs basic reasons

# Solutions… in OSMO tested:

- Lime
- Gypsum: Yara & nature gypsum
- Ammoniumsulphate
- Manganesesulfate on seeds
- **Boron**
- Kaliumsulfaphate
- Chicken manure
- Cattle manure
- **Subsoiling**
- Cultivating deep vs shallow disc
- Diversified greenmanuring and crop rotation

- Biotite stoneflour
- Biocarbon
- Moalditches
- **Clearing ditches**
- Field formulation
- Slurry spreading with pullhose

# Plan of using impromentsfor soil health

## Plan för skötsel av jordhälsa

Gård OSMO provfält År 2015

### Kemiskt tillstånd

| Fält | CEC | pH | Ca/Mg | P | K | B, S | Zn, Cu | Mn |
|---|---|---|---|---|---|---|---|---|
| He | 23 | -1 | 1 | 1 | | 1 | | 1 |
| Hy | 24 | | 1 | 1 | | 1 | 1 | 1 |
| Ju | 29 | -1 | 1 | 1 | 1 | 1 | | 1 |
| Kä | 26 | 1 | | 1 | 1 | 1 | 1 | -1 |
| Lu | 6 | | | -1 | -1 | 1 | | 1 |
| Ha | 21 | | | 1 | 1 | 1 | | |
| Pa | 8 | | | -1 | 1 | 1 | | 1 |
| Sa | 14 | -1 | 1 | -1 | | 1 | | 1 |
| | 15 | | | | | | | |
| | 15 | | | | | | | |
| | 15 | | | | | | | |
| | 15 | | | | | | | |
| | 15 | | | | | | | |

### Fysikaliskt tillstånd

| Fält | Jordart | Kantdiken | Täckdiken | Jordpackning | Ytans form | Bearbetningssätt |
|---|---|---|---|---|---|---|
| He | Medeltunga | | 1 | 1 | | 2 |
| Hy | Medeltunga | 1 | 1 | 1 | 1 | 3 |
| Ju | Tunga | | 1 | 1 | 1 | 3 |
| Kä | Tunga | | | | 1 | 3 |
| Lu | Lätt | | | 1 | | 1 |
| Ha | Medeltunga | | | 1 | 1 | 2 |
| Pa | Lätt | 1 | 1 | 1 | 1 | 2 |
| Sa | Medeltunga | 1 | | 1 | 1 | 4 |
| 0 | Medeltunga | | | | | 1 |
| 0 | Medeltunga | | | | | 1 |
| 0 | Medeltunga | | | | | 1 |

| Bearbetningssätt | |
|---|---|
| 1 | Kultiv. |
| 2 | Plöjning |
| 3 | Tallriksr. |
| 4 | Direkt |

| Jordtryck | kPa 15 cm |
|---|---|
| Traktor | 50 |
| Traktor | 50 |
| Tröska | 130 |
| Vagn | 100 |
| Vagn | 300 |

## Åtgärder

### Kemiskt tillstånd — Kalk och Jordförbättring — Mikronäring

| Fält | Ämne | Areal | t/ha | €/t | € | Blandning | €/ha | € |
|---|---|---|---|---|---|---|---|---|
| He | Gips | 2 | 6 | 60 | 720 | Bor | 20 | 40 |
| Hy | Gips | 2 | 4 | 60 | 480 | Bor | 20 | 40 |
| Ju | Kyckling gödsel | 4 | 6 | 20 | 480 | Bor | 20 | 80 |
| Kä | Nöt gödsel | 5 | 40 | 10 | 2000 | | 0 | 0 |
| Lu | Biokol | 2 | 8 | 80 | 1280 | Bor | 20 | 40 |
| Ha | Biotit | 3 | 5 | 80 | 1200 | | 0 | 0 |
| Pa | | 4 | | | 0 | Kaliumsulfat | 200 | 800 |
| Sa | | 5 | 0 | 0 | 0 | Bor | 20 | 100 |
| 0 | | 0 | 0 | 0 | 0 | | | 0 |
| 0 | | 0 | | | 0 | | | 0 |
| 0 | | 0 | | | 0 | | | 0 |
| 0 | | 0 | | | 0 | | | 0 |
| 0 | | 0 | | | 0 | | | 0 |
| 0 | | 0 | 0 | 0 | 0 | | | 0 |

### Fysikaliskt tillstånd — Dikning, djupavluckring — Nya maskiner

| Fält | Åtgärd | Areal | €/ha | € | Anskaffning | € |
|---|---|---|---|---|---|---|
| He | | 2 | | - | Djupluckrare | 8000 |
| Hy | Djupluckring | 2 | 70 | 140 | | 0 |
| Ju | Djupluckring | 4 | 70 | 280 | | |
| Kä | | 5 | | - | | |
| Lu | | 0 | | - | | |
| Ha | Djupluckring | 3 | 70 | 210 | | |
| Pa | Rensning av diken | 4 | 100 | 400 | | |
| Sa | Rensning av diken | 5 | 100 | 500 | | |
| 0 | | 0 | | - | | |
| 0 | | 0 | | - | | |
| 0 | | 0 | | - | | |

Skötsel av jordhälsa Excel verktyg 2019

# Farm example Sa:
# Increasing soil physical fertility

Kuvat: Jukka Rajala

Visual soil stucture assessment

0-5 cm good structure

6-20 cm compacted
Few roots

Tillage: Light disc + direct sowing

In subsoil few roots, compacted


# …and in rainy periods

The permeability of soil is not good enough
=>Deeper layers of soil is water logged
=>Deficiency of oxygen

=>Roots and soil life is suffering, and soil structure

# Sa: Deficiencies of physical soil fertility


Kuva: Jukka Rajala

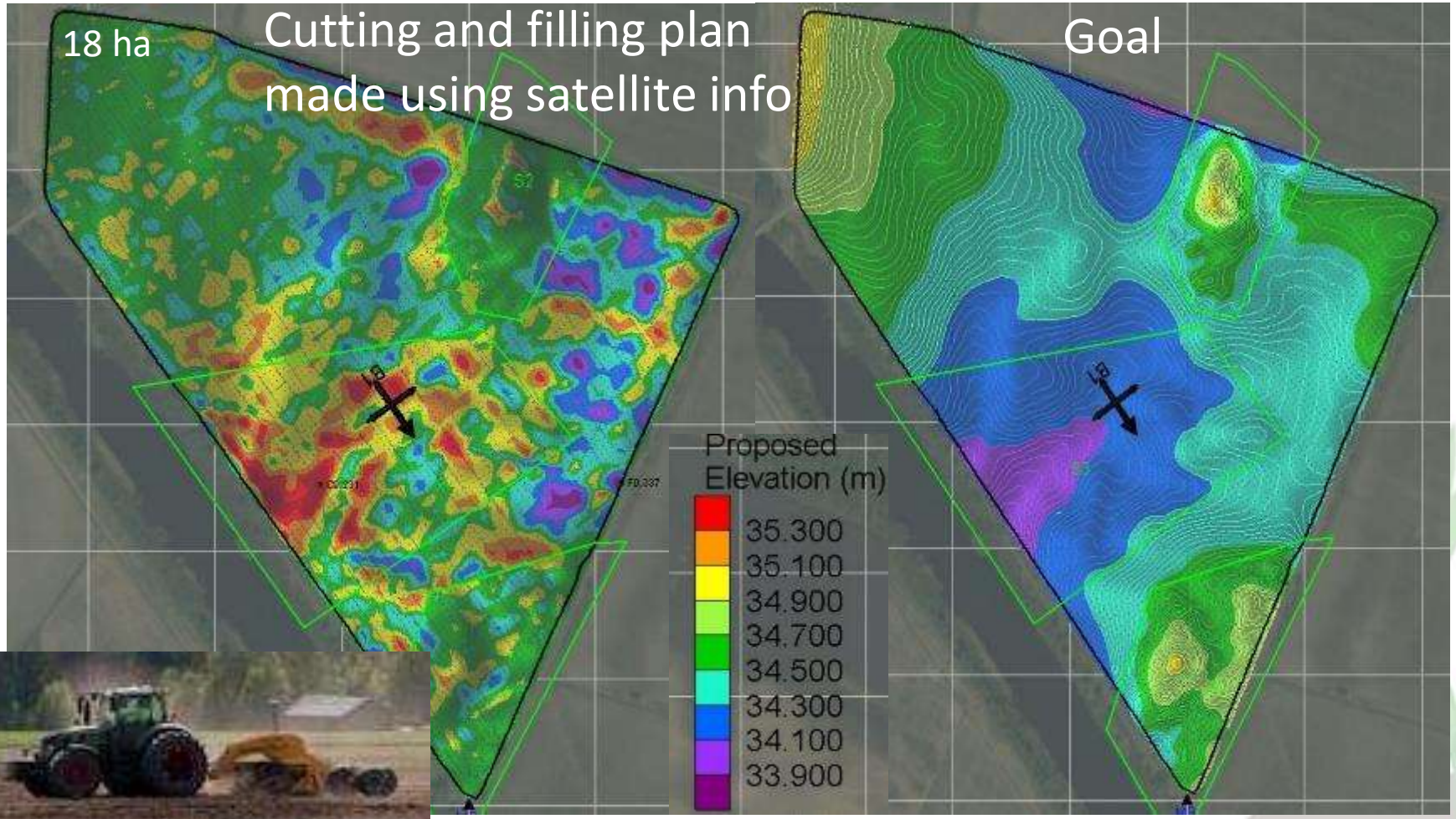
- Water ponds on the field
- Permeability too low
- Poor root growth/root channels
- Earthworms at the 0-5 cm, but not deeper
- Site ditches too low
- Water level at river is variable
  When water is high, the field will be wet

# Recipe for soil healing
# Sa: Measures 2016-2017

- Deeper tillage; From shallow disk to deep cultivating
- Cleaning side ditches
- Diversifing crop rotation with grass leys and winter cereals + cover crops (instead only summer cereals since years)
- Subsoiling in summer in grass ley
- Field leveling with soil from site ditches and automatic grader
- Gypsum for correcting Ca:Mg
- Subsoiling when sowing winter rye (after heavy traffic of field leveling)
- Better tires to tractor => Lower tire pressure

# Grass clover ley + subsoiling works well

# Well planned field leveling

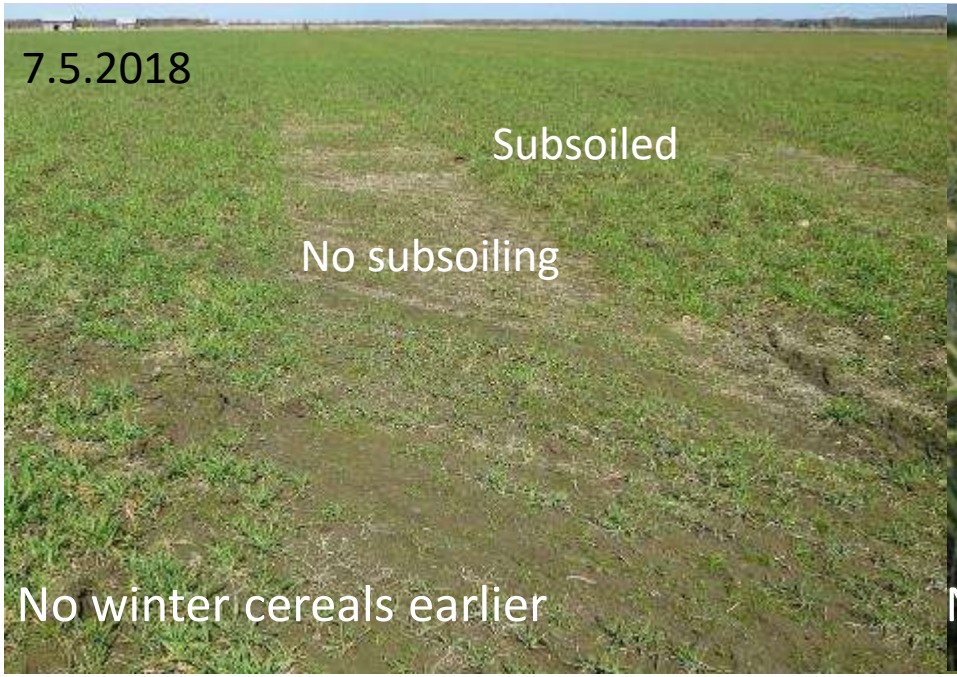




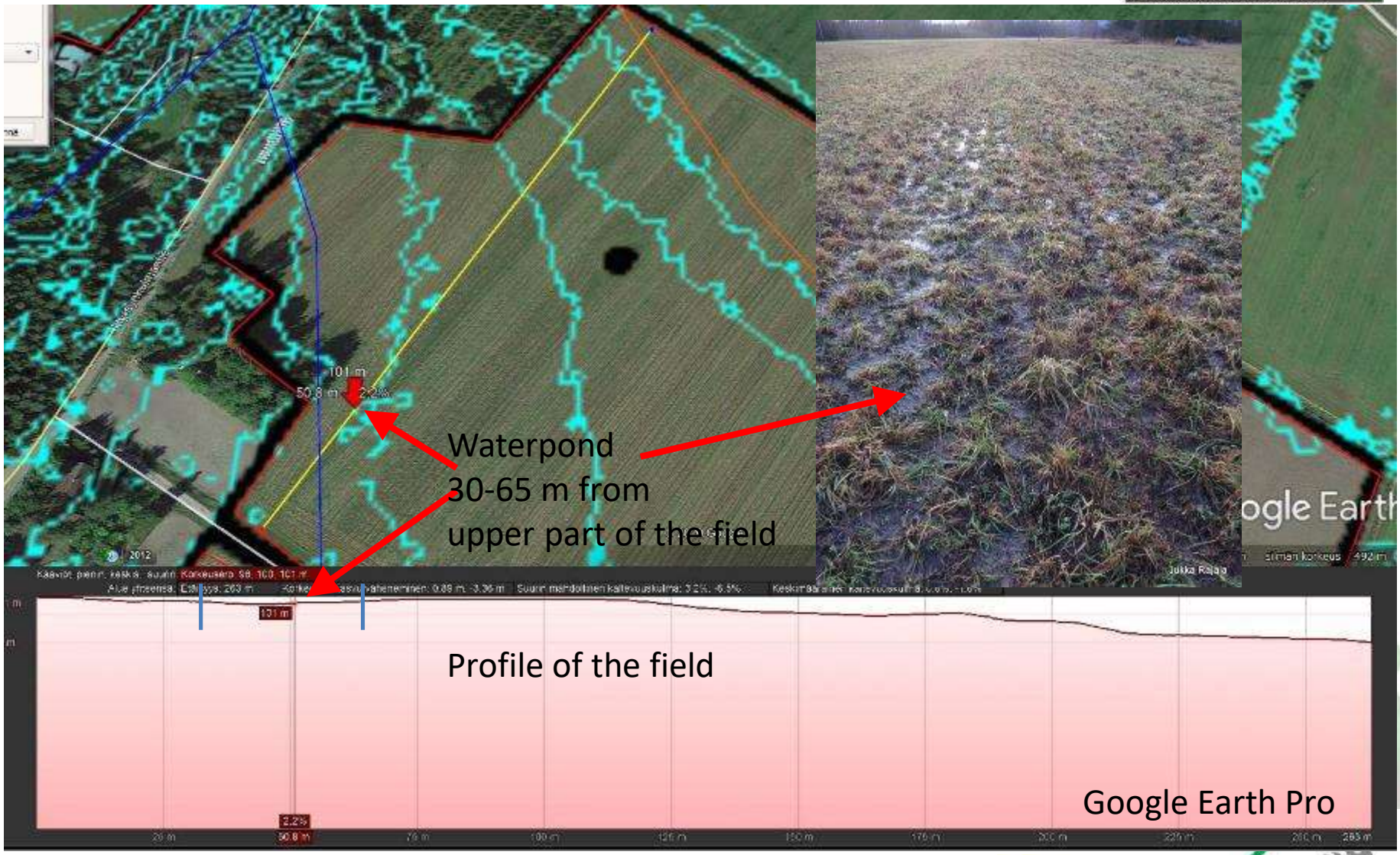

Automatic grader at work

# Monitoring: Fixing measures were good enough

- Changes in crop rotation
- Changes in tillage
- Biol. tillage with deep rooting plants
- Mechanical subsoiling

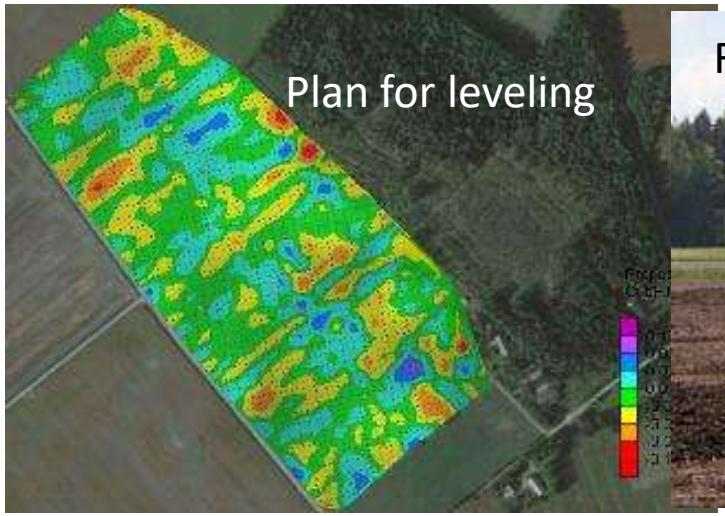



# Topography of a field



# Improvements on farms?

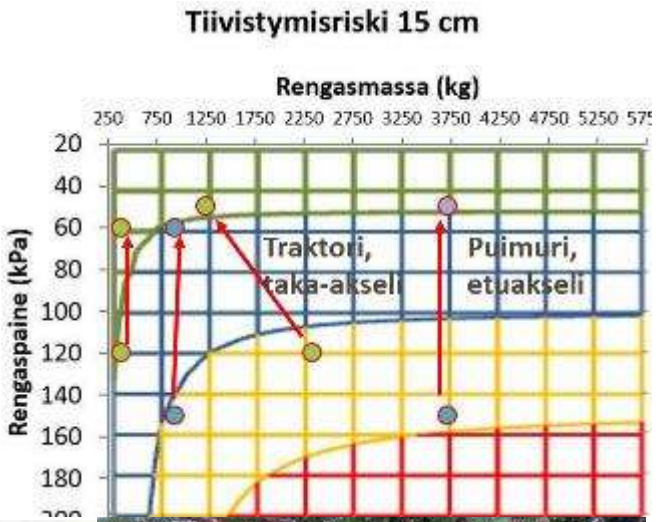
- Drainage improved
- Drainage pipes added
- Field leveling



# Improvements on farms

- Compaction risks monitored
- Tire pressures regulated for diff works
- Proper tillage (the need of soil checked)
  More cultivating
- On-land plowing





Kuva Ville Virtanen


Kuvat: Jukka Rajala


Kuva: Timo Erkkilä

# Improvements on farms

- Lowered wheel loads
- Changes in machineries
- More dual wheels
- Better tires


# Improvements on farms

- Liming more precis (type, need)
- Gypsum in use
- More precis K-fertilisation
- Better micronutrients fertilisation
- CEC, nutrient ratios
- More organic fertilizers, biotit, circulation

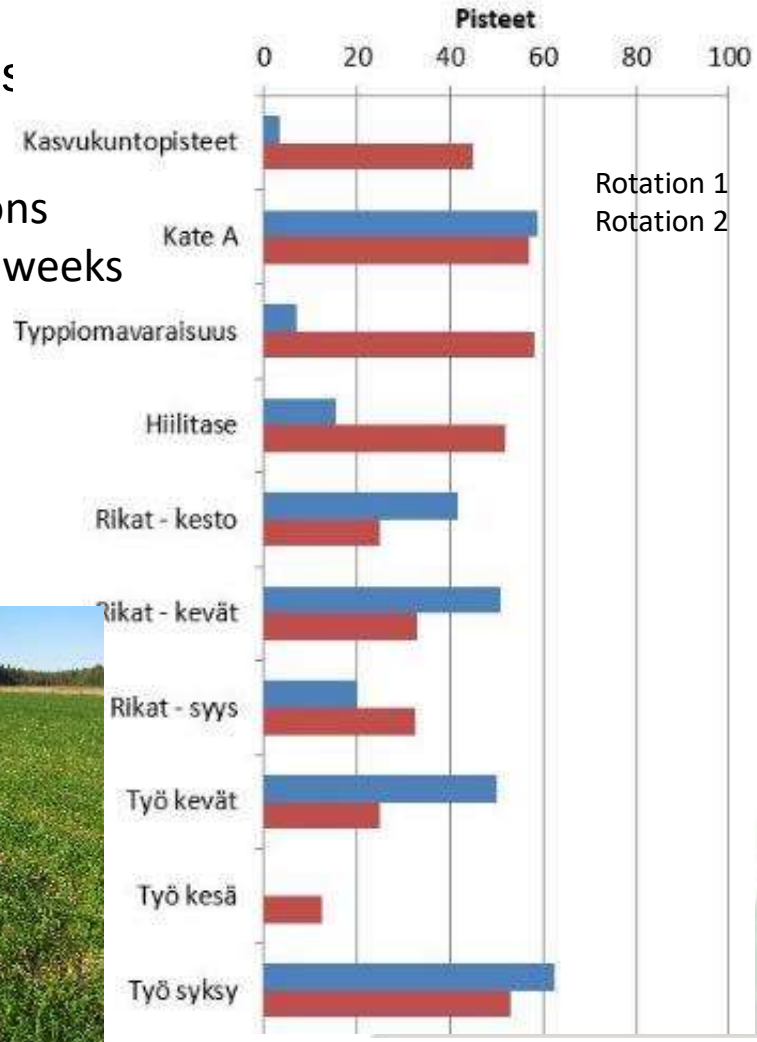
KVK-laskuri

| Analyysitulokset | | | | | mg/l | | | | meq/dl | | % KVKsta | | | | | kg/ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Näyte | Maalaji | Multavuus | pH | Ca | Mg | K | Na | Ca:Mg | KVK | Ca | Mg | K | Na | Yht. | Ca | Mg | K | Na |
| Mattila | HeS | rm 9,9 | 7,0 | 3900 | 680 | 230 | 60 | 6 | 27 | 72 % | 21 % | 2 % | 1 % | 97 % | -474 | -584 | 65 | 4 |
| Ojapelto 2 A | HeS | rm | 6,9 | 3500 | 1100 | 180 | 60 | 3 | 29 | 61 % | 32 % | 2 % | 1 % | 95 % | 850 | -1369 | 203 | 13 |
| Ketopelto | HtS | rm 11,1 | 6,8 | 3400 | 950 | 340 | 60 | 4 | 28 | 61 % | 28 % | 3 % | 1 % | 93 % | 802 | -1095 | -135 | 9 |
| Riihipelto | HtS | rm | 6,5 | 3300 | 1600 | 330 | 60 | 2 | 35 | 47 % | 38 % | 2 % | 1 % | 88 % | 2953 | -2189 | 25 | 42 |
| Riihipelto | HtS | rm | 6,0 | 2900 | 770 | 450 | 60 | 4 | 28 | 52 % | 23 % | 4 % | 1 % | 80 % | 1831 | -732 | -353 | 9 |

# Soil healing with Crop rotation

- More diversified and soil healing rotations
- Soil healing crops
  -grass-clover leys
  -winter cereals
  -winter oil plants
  -caravay
  -henf
- Covercrops, catchcrops

Tool to
compare 2 rotations
+ counting Green weeks




Kuvat: Jukka Rajala

# Results ½ - Farm research

•In analyzing the soil health of eight test fields, each field was **found to have its own set of problems**. Poor growth was caused by poor drainage, compaction in the top soil and subsoil, nutrient deficiencies (especially micronutrients), poor biological activity, and low soil organic matter.
•Upon identifying the factors impacting soil health and by reducing crop yield, the farmers used the information and tools developed through the project to plan effective ways to remedy them.
•11 study reports, 8 planning tools, 30 leaflets and many PowerPoint presentations have been published.
•45 articles have been published in professional magazines ensuring a wide dissemination of relevant information about soil health management.

# Feedback from participitants

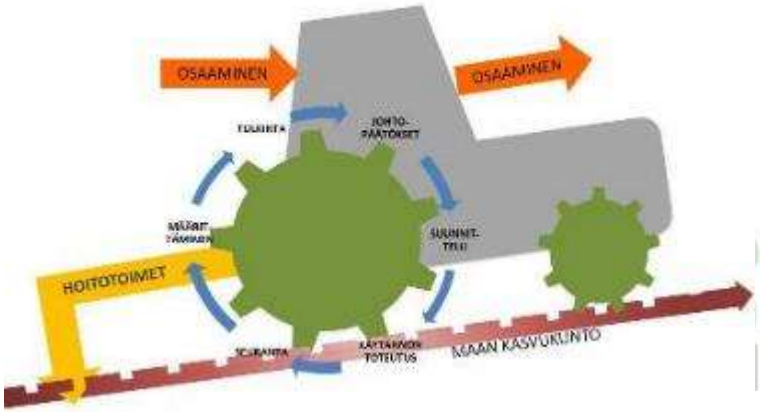
- *Theoretical knowledge and practical tools in good mix/balans*
- *Present of course day was very good, in every farmers lectures was the theory brought into practical farm level*
- *The course day was very useful for my farm*
- *Good package and wake up to think in own mind and doing*
- *Relaxed atmosphere and very profitable discussions*
- *Now I´m looking my farming with new eyes and the course gave me the motivation to try new methods at my farm*
- *The experience of teachers is visible*
- *Motivating meeting*
- *Thanks for good course day!*

# Key lessons

- **Identifying and remedying soil health problems** and enhancing soil quality, organic matter and structure may increase farm productivity, but it also reduces the potential impacts from extreme climate conditions by building agroecosystem resilience and adaptation capacity.
- **Simplified decision support tools** are needed, but they must account for the complexity of soil systems in relation to the potential options and recommendations for farm management.
- **The project's results are transferable** and have the potential to have a wider impact, with 30 advisers under the MAANEUVO project are in  training on how to effectively use the methods and tools developed in the OSMO project.
- Additionally, **the results are applicable** to and may be used by all farmers, advisers, trainers and researchers to improve soil health management.

# Conclusions

- 1. Monitor soil healt status – What´s the problems?
- 2. Make questions – right questions
- 3. Find out different measures to heal
- 4. Prioritize and plan in long run
- 5. Choose and put into practice 3-5 healing measures /y
- 6. Monitor – Is direction right?
- 7. Think and act in long run



Soil Health Management ABC

# 1.Basic factors to satisfaction level

- Drainage: No water can flow to the field outside and water can flow away from the field fast enough
- Prevent water ponds on the fields
- pH to the level moderate –good
- Avoid compaction, tire pressures in spring works 0,5 bar or with heavy machinery use fixed tire lines
- Soil samples taken from different textures and from different SOM–levels separately

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# Soil Health Management ABC
# 2.Remove factors, which restrict growth


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- Remove compacted layers with right kind of deep tillage
- Keep soil structure good covering soil with green crops
- Add deep rooting crops and soil health increasing crops in rotation to add SOM
- Use CEC and water storage capasity to estimate need to increase SOM
- All macro- and micro  nutrient status to classes moderate- good or use foliar fertilisation
- Improve drainage to the level, where roots can grow well and groundwater level stays far below topsoil

# Soil Health Management ABC

# 3.Monitoring

- Wide soil sample analysis every 5.th year
- Monitoring differences in growth inside the field (yield mapping, biomass in satellite pictures, drone pictures)
- Spadediagnosis regularly VESS/MARA
- Mineral content analysis of crops in summer

| Analyysitulokset | | | | | mg/l | |
|---|---|---|---|---|---|---|
| Lohko | Maalaji | Multavuu | pH | Ca | Mg | K |
| Luoma | HtMr | vm | 5,6 | 336 | 40 | 75 |
| Haavisto | HHt | m | 6,7 | 2280 | 44 | 110 |
| Joenranta | HeS | m | 7,0 | 3700 | 890 | 200 |
| Poikaro | HtS | m | 6,3 | 4200 | 1200 | 330 |

# OSMO-Research Reports of Soil Health

https://www.helsinki.fi/fi/ruralia-instituutti/koulutus/maan-kasvukunto


# OSMO-verktyg på svenska

Leaflets

- Markstrukturkort för Utvärdering av jordstruktur på åker –=>Välja språket sv =>Välja presentation mode
- Förhindrande av markpackning: tajmning, växtföljd och maskinkedjor (2021)
- Formning av åkerns yta (2021)
- Test med titerpaltta för att definiera aggregatstabiliteten (2021)

Verktyg på svenska
https://www.helsinki.fi/fi/ruralia-instituutti/koulutus/maan-kasvukunto/verktyg-for-planering-av-skotsel-av-jordhalsan

- Alla OSMO-materialen https://www.helsinki.fi/fi/ruralia-instituutti/koulutus/maan-kasvukunto

Satellite photos
https://asiointi.maanmittauslaitos.fi/karttapaikka/
https://apps.sentinel-hub.com/sentinelplayground/?source=S2L2A&lat= 40.4&lng=-3.730000000000018&zoom=12&preset=1_TRUE_COLOR&layers=B01,B02,B03&maxcc=20&gain=1.0&gamma=1.0&time=2021-04-01%7C2021-10-28&atmFilter=&showDates=false

# More information

OSMO project at University of Helsinki webpage
https://researchportal.helsinki.fi/en/projects/knowhow-and-tools-for-resource-efficient-soil-health-management-i
Materials of Soil Health produced by the OSMO-project
Short link www.maan-kasvukunto.fi

Scientific articles:
Mattila T.J. and Rajala J. 2021. Do different agronomic soil tests identify similar nutrient deficiencies? Soil Use and Managent, 04 July 2021.
https://doi.org/10.1111/sum.12738

Mattila T.J. and Rajala J. 2021. Estimating cation exchange capacity from agronomic soil tests: comparing Mehlich-3 and ammonium acetate sum of cations. Soil Science of America Journal.
https://doi.org/10.1002/saj2.20340

Lots of different maps and aerial photos, also old ones
https://kartta.paikkatietoikkuna.fi/?lang=en
For example: Select Map layers => Aerial photos and orthophotos => Old aerial photos

MULTA –project is collecting real time data from 20 fields

https://www.fieldobservatory.org/

# Thankyou!

## OSMO


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www.maan-kasvukunto.fi