GROW Information Package

Olson-Sawyer, Devyn; Whelan, Ben; Long, Deborah

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

DELIVERABLE 2.2

GROW Information Package

Report

DELIVERABLE 2.2

PROJECT ACRONYM	GRANT AGREEMENT #	PROJECT TITLE
GROW	690199	GROW Observatory

AUTHORS

Devyn Olson-Sawyer	Ben Whelan	Deborah Long
CULTIVATE	CULTIVATE	UNIVDUN

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690199

DISSEMINATION LEVEL

PU Public

REVISION HISTORY

REVISION	DATE	AUTHOR	ORG	DESCRIPTION
v0-01	11/04/2017	William Slater	UNIVDUN	Outline Template
v0-02	18/04/2017	Devyn-Olson-Sawyer	CUL	Content Draft
v0-03	24/04/2017	Devyn-Olson-Sawyer	CUL	Final Draft
v1-00	28/04/2017	Drew Hemment	UNIVDUN	Released
v1-01	18/10/2018	Devyn Olson-Sawyer	CUL	Updated following EC Review / feedback
v1-02	19/10/2018	Deborah Long	UNIVDUN	Review
v2-00	19/10/2018	William Slater	UNIVDUN	Re-submission

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1. Scope of the GROW Information Packages

GROW Information Packages are a method to gather and catalogue different types of information intended for the specific users and associated audiences, networks and media targeted by the project. These information packages can be curated and tailored around different themes, and for users of various knowledge levels and interests, and are made available at different stages of the user's journey through GROW.

The GROW Information Packages are one element in implementing the Communication Plan – specifically by delivering elements of the Communication Plan objectives as described below:

- O2.1 Create high levels of visibility and awareness across Europe for GROW and the EC Citizen Observatories programme and promote it as a mainstream part of European culture.

- O2.2 Recruit participants and generate widespread and sustained levels of participation in Missions, by building on the current capacity of the GROW network, establishing a Europe-wide network of Community Champions, and delivering support mechanisms.

- O2.3 Establish GROW as a central hub for land and growing information by curating and delivering high quality, widely used information and educational services. The objective of this task is to curate & manage information resources and social channels on the GROW website, which are collectively described as the Collaboration Hub.

2. Identifying Audiences and Users

To encapsulate GROW audiences, we have developed Design Personas. Design Personas are an effective method to portray user-focused insights for a new product or service. We can now use the insights and personas to compile and distribute tailored information packages.

The development and discovery of personas will continue throughout the project as we engage with participants. This allows us to continue to deliver tailored information packages as the project evolves.

2.1 Growing

The majority of the participants in the GROW community will be growers. Growers are key to GROW as they manage and have a direct relationship to the land and soil. Most of the work in design personas as described above has been focused on growers, and include the following:

- Nicolette, part time grower, 37, France
- Miroslav, Commercial Mixed Producer, 41, Slovakia
- Florian, Urban Millennial, 28, Freiburg, Germany
- Sofía, Sustainability Activist, 34, Barcelona, Spain
- Frank, Allotment Owner, 61, Ireland
- Irene, Garden Grower, 58, South East England

2.2 Policy and Advocacy

There are a number of important and interrelated soil, land, climate and other issues that concern policy makers and other advocacy actors (e.g. NGOs). The scale of citizen science experiments means that GROW can help this audience better understand agri-environmental impacts.

Policy and advocacy audiences will be developed under the categories below:

- Policy advisors and policy makers
- Campaigners and campaign groups
- NGOs and CSOs
- Local authorities
- Food Policy Councils

2.3 Science and other Specialist Users of GROW Data or Services

Scientific and research communities, as well as businesses and industry in areas such as Earth Observation, will be engaged primarily with the unprecedented soil moisture dataset GROW will develop. Through GROW Service Innovation, data, information and findings will be created for incorporation in relevant information packages.

Science and specialist user audiences will be developed under the categories below:

- Satellite and Soil Scientists
- Weather and Climate scientists
- Agricultural scientists and agri-extension service providers
- Open Hardware Community
- Existing Citizen Scientists
- School Teachers, Students, Colleges
- IGOs (Intergovernmental Organisations)
- Industry innovators and entrepreneurs

3. Tools

GROW Information packages will include resources tailored for these audiences. They will be curated and disseminated through various channels detailed below, and delivered in PDF or other format as appropriate. . The aim is also to include Information and resources in searchable formats with hashtags so audiences can access and curate their own information packages, and also collected into cohesive narratives with tools like Storify.

3.1 GROW website

The GROW website, www.growobservatory.org, centred on the GROW Collaboration Hub described below, is our main tool for building community and disseminating materials. During the project participants will be able to interact with the GROW team and each other using a variety of communication tools, and all these tools will be accessible through the GROW website.

3.2 GROW Collaboration Hub (CH)

The CH is an online community and platform for growers, scientists and others to participate in contributing, accessing, making sense of and using GROW data. The CH provides entry points to the GROW citizen science tools and MOOCs running over several weeks, and outside the MOOCs with observations and experiments that can last many months. The CH is a space for users to upload and explore data from their growing experience and citizen science experiments, discuss findings and share stories. Crowdsourced data from scientific experiments carried out in the GROW Missions will be shared, communicated, interrogated, accessed and visualised via the GROW CH. The CH is an online home for the GROW community, and it promotes deeper engagement.

3.3 Social Media

GROW Observatory is active on social media, and there are currently active accounts on Twitter, Facebook and Instagram. Participants will help the GROW team shape the social media interactions, as we engage them in conversation on these and other channels.

Twitter - https://twitter.com/growobservatory
Facebook - https://www.facebook.com/GROWObservatory/
Instagram - https://www.instagram.com/growobservatory/

3.4 Content Media

As the project develops, we will be creating new content in our theme areas. In addition to this, we will be encouraging and facilitating participants to tell their own stories about their soil and growing, and about their journey through their GROW experience. These written stories will be held in blogs on the GROW website, as well as on Medium, while video content will be hosted on GROW channels on Vimeo and YouTube. Through MailChimp, we will be sending regular newsletters, targeted by interests.

Medium – https://medium.com/grow-observatory-blog
Vimeo – https://vimeo.com/growobservatory
YouTube - https://www.youtube.com/channel/UCYgPDj2gQXHvOUau4YbfVqg

3.5 Education Media

GROW has partnered with leading online platform FutureLearn (www.futurelearn.com) to deliver free online courses throughout the project. These Massive Open Online Courses (MOOCs) will allow participants to engage with GROW and other participants through meaningful learning experiences. The first course is Citizen Science: From Soil to Sky, where learners will get to know their site and soil and understand them in the wider landscape ecosystem.

There will be significant material developed for the courses, and some will be repurposed in information packages.

3.6 GitHub Media

While narrative and visual content will be of interest to many of our participants, there will be some who will want to engage with GROW through data, software and code. To interact with these users, GROW will use GitHub to host, develop and share software and code. Information and access to GitHub resources can be part of the information packages.

https://github.com/growobservatory

4. Growing – Sample Information Pack

Below is a specification of indicative content for tailored growing information packages. Each package would contain between 5-10 assets.

4.1 Community Garden Information Pack

- Ways to engage with GROW
- Video playlist – protocols for soil observations and experiments
- Inspiration stories – stories highlighting community gardens around Europe
- Themed social media - hashtags such as #communitygarden #soil
- Curated how-to guides: for example, advice and guidance for community gardens, the best plants for your soil type and location
- Invitation to community garden forum on Collaboration Hub

4.2 Small-scale Farmer Information Pack: “Know your Soil” (Appendix 1)

- Ways to engage with GROW
- Introduction - the importance of healthy soil
    - GROW blog: The Soil Jungle Beneath Your Feet
    - GROW blog: Part 1 | What makes a Healthy Diet — for People, Plants and Soil?
    - GROW blog: Part 2 | What Makes a Healthy Diet? How to be a Soil Doctor
- Landscape and Soil Relationships
    - Landscape Representivity
    - Anatomy of a Soil Profile (draft, not complete)
- Tips and How to guides
    - GROW blog: Handy Tips To Know Your Soil Type and Soil Texture
    - GROW You tube film: Assessing Your Soil: Soil Texture by Hand
    - GROW guide: Understanding Soil Texture and How to do a Soil Survey

4.3 Garden and Allotment Holder Information Pack: “GROWing for All Ages” (Appendix 2)

- Ways to engage with GROW
- Video playlist – protocols for soil and growing observations and experiments
- Inspiration stories – stories highlighting productive gardens around Europe
- Film inspiration: short online films by GROWers from across Europe
- Themed social media - hashtags such as #hort #permaculture #soil
- Curated how-to guides: for example, advice and guidance for gardeners and allotment holders, the best plants for your soil type and location
- Map of growers across Europe and the data they are collecting
- Invitation to community garden forum on Collaboration Hub

4.4 New GROW Participant Information Pack

- MOOC invitation
- Ways to engage with GROW
- Inspiration stories – a grower’s story about participating in a GROW online course
- Themed social media - hashtags such as #citsci #soil
- Curated how-to guides: for example, how to plan a garden, the best plants for your soil type
- Introductory and promotional films, available through the Grow website, GROW MOOCs and via Vimeo and YouTube
- GROW app

4.5 Families and new growers Information Pack: Growing for all ages

- Ways to engage with GROW
- Meet the GROWers
    - GROW blog: GROWing Roots — with time, talking and tactile experiences

    - GROW blog: GROW Place Ireland | Citizen Sensing in Community Gardens
- GROW Activities
    - Acid and Alkaline Soil test (plus magic lemonade!)
    - Build an Earthworm Hotel
    - Social Media Pledge Cards

5. Science – Sample Information Pack

Below are lists of potential content for tailored science information packages. Each package would contain between 5-10 assets.

5.1 Soils Researcher Information Pack

- Inspiration story: what can GROW do for the science community
- Onboarding PDF – Getting the most out of the GROW Collaboration Hub
- Outline report listing the types of experiments and data collected
- Themed social media - hashtags such as #soilhealth
- Data visualisation and information outputs
- Map of GROW Focus Areas
- Contact details: science@growobservatory.org

5.2 Data Specialist Information Pack

- Onboarding PDF – Getting the most out of the GROW Collaboration Hub
- PDF listing the types of experiments and data collected
- Themed social media - hashtags such as #data
- Data visualisation and information outputs
- Map of GROW Focus Areas
- GitHub outputs
- Outputs from GROW Service Innovation Group (SIG) demonstration seminars and technical workshops

6. Policy – Sample Information Pack

Below are lists of potential content for tailored policy information packages. Each package would contain between 5-10 assets.

6.1 Local Authority / City Forum Information Pack

- Inspiration story – relationship between the project and regional policy makers
- Case studies from policy makers who have used and applied GROW advice in policy making
- Localised contact information - Regional groups signed up to GROW, interested in policy making in their locality
- Outline report listing the types of experiments and data to be collected
- Documents on selected key policy issues and the GROW data available to support policy decisions at regional level
- Map of GROW Focus Areas
- Data visualisation example

6.2 National Government Information Pack

- Inspiration story – relationship between the project and national government policy makers
- Case studies from policy makers who have used and applied GROW advice in policy making
- Policy consultation responses and comments from the GROW team (link to PDFs or blogs)
- Documents on selected key policy issues and the GROW data available to support policy decisions at national level
- Map of GROW Focus Areas
- Data visualisation example
- Contact details: policy@growobservatory.org

6.3 International Policy Information Pack

- Inspiration story – relationship between the project and international policy makers
- Case studies from policy makers who have used and applied GROW advice in policy making
- Policy consultation responses and comments from the GROW team (link to PDFs or blogs)
- PDF documents on selected key policy issues and the GROW data available to support policy decisions at international level
- Map of GROW Focus Areas
- Data visualisation example
- Contact details: policy@growobservatory.org

7. Press/Media – Sample Information Pack

Below is a list of potential content for tailored press information packages.

7.1 Press Information Pack

- Current press release – general release
- Localised contact information
- Web ready and print ready photographs
- Sample illustrations
- GROW logos and icons
- Inspiration story collection highlighting participants experiences in GROW
- Outline report listing the types of experiments and data to be collected
- Data visualisation example

8. Conclusion/Next Steps

The GROW Information Packages will evolve over time, and the individual components can be delivered in numerous configurations so that the project can continue to address questions and provide relevant information as it progresses. Participants will not only learn from the project activities, but will also actively contribute to and enrich the information packages, sharing their stories and their data. Throughout the life of the project, the team will trial and implement various tools and approaches to curating and disseminating information in open and accessible formats. Continued innovation and evolution in GROW Information Packages can be a key enabler for expected project impacts.

Appendix 1: Small-scale Farmer Information Pack: “Know your Soil”

Know Your Soil

A GROW Observatory Info Pack

GROW
OBSERVATORY

Contents

Note: This is an example of an info pack for Deliverable 2.2. Some of the content for this info pack are in final production as of 20/10/2018, but will be in the final info pack.

https://medium.com/grow-observatory-blog/handy-tips-to-know-your-soil-type-and-soil-texture-85feee0fd356)

Assessing Your Soil: Soil Texture by Hand (accessed on the GROW Observatory YouTube channel at https://www.youtube.com/watch?v=fv3JCciOhrE)

Understanding Soil Texture and How to do a Soil Survey

Ways to engage with GROW OBSERVATORY

Keep in touch with GROW through social media and our e-newsletter

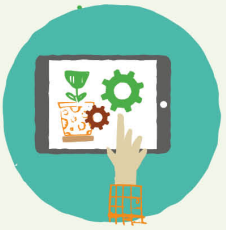
Register for our next online courses

Connect with other growers from all over Europe

Interact with the GROW online community

Be inspired with films and stories on soils, growing and satellites

Sign up to future observations and learning



Discover data and insights from our first citizen scientists' observations

Find out more: growobservatory.org @GROWobservatory

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 690199

GROW Observatory
Let's collaborate to grow great food, improve our soils, and help science with vital environmental monitoring. Get involved! http://growobservatory.org/
Aug 7, 2017 · 3 min read

The Soil Jungle Beneath Your Feet

Photo by NRCS Soil Health. Soil Health: Soybeans Planted into Winter Wheat Stubble photo (CC BY 2.0)

Written by Roy Neilson, James Hutton Institute

The next time you walk into the garden, take a moment and tread very carefully across the soil.

You are walking on top of arguably one of the most diverse habitats on earth. Soil is a jungle, with forests of fungal hyphae interspersed with bacteria and watering holes located between the soil particles. Creatures roam, moving over and between the soil particles, riding the wave of the water table scooping up plant material, predating on each other, reproducing (they make bunnies look lazy!!) and pooping highly nutritious material for plants to take up and produce crops.

Since you are in the garden, bend down and pick up approximately one teaspoon of soil. You are now holding in your hands a wonderful diversity of living matter and numerically more living organisms than there are humans on the planet. Soil is teeming with wildlife that come

in all shapes and sizes from the iconic earthworm (Fig. 1) to microscopic nematodes (Fig. 2), protozoa, bacteria and viruses, just to name a few (there are many more soil animals) and they drive all the major soil processes.

Figure 1. *Lumbricus terrestris* known as the "common earthworm". An anecic species that forms deep burrows and comes to the soil surface to feed.

Figure 1

If the soil is healthy and depending on the soil texture (sandy, clay or loam), in one gram of soil you are likely to be holding up to 1 Billion (yes, really!!) bacteria; 100,000 protists; 100s of nematodes, 1 earthworm, metres of fungal hyphae and many more bugs and beasties.

Figure 2. *Anatonchus tridentatus*, a predatory nematode (left), feeding on an unsuspecting juvenile omnivorous nematode.

Figure 2

Each and every soil animal has a role to play whether it be beneficial, for example, by releasing nutrients from organic matter to be taken up by plants or detrimental such as causing crop disease. We simply are unable to live without these creatures as they contribute to many soil services that we take for granted (e.g. food production, landscape drainage). Yet pressures on soil and its plethora of animals is increasing through a changing climate, intensification of agricultural production and urbanisation. Consequently, global soil erosion has increased with

an associated loss of organic matter, the fuel for these soil animals, contributing to reduced soil fertility and stagnating crop yields. It is only in recent years with the onset of new DNA-based technologies that researchers have been able to begin to untangle the complex relationships and roles of soil animals leading to a better understanding of the crucial role they play to support the very foundation of life.

So the next time you walk into the garden, take a moment, tread very carefully across the soil and be amazed at the world beneath your feet.

To sign up for GROW Observatory's next free MOOC (Massive Open Online Course) click here ! Starts 19th February, four hours per week over four weeks!

oliver moore
Food, farming, organics, environment: column @IrishExaminer; Communications arc2020.eu; PhD sociology; UCC's Cntr for Co-op Studies; Views mine RT not support!
May 23 · 5 min read

Part 1 | What makes a Healthy Diet—for People, Plants and Soil?

Part 1 of a two parter by ***Stephanie Reiter (****Global Soil Partnership Secretaria)* ***and Lucrezia Caon (****UN Food and Agriculture Organization). This part introduces soil, and a soil 'diet plan' while part two focuses on how to be a soil doctor.*

Just as we feel better when we eat a healthy diet, plants grow better on soils that provide them with a healthy diet. No matter which diet we choose for ourselves, our bodies and minds are fueled by what we eat, and food production is powered by its soils' diet. We need to know what makes a healthy soil diet. To start, there is an unquestionable link between the nutritional value of the food we consume and the health of the soil on which it grows. Globally, about 95% of our food is directly or indirectly produced on soils.

There are 17 of what are called Global Goals, or Sustainable Development Goals (SDGs). These have been developed by the United Nations to help improve socio-economic and environmental conditions in the world. If we want to achieve Sustainable Development Goal 2 – Zero Hunger—"End hunger, achieve food security and improved nutrition and promote sustainable agriculture", if we want in fact to

improve human nutrition and work towards ending malnutrition, we need to make sure that our soils are healthy too.

For more GROW Observatory articles on agri-food and environmental policy see our dedicated policy section

Healthy soils supply water, oxygen, and all essential nutrients that crops need to grow and flourish. The core of a healthy soil diet are relatively large amounts of the **primary macronutrients** nitrogen, phosphorus and potassium. These three main *ingredients* are vital to plants and required in large amounts to ensure plants grow, flower and produce. Nitrogen plays a central role in plant metabolism as a constituent of proteins, nucleic acids, and is a critical component of chlorophyll, which is essential for photosynthesis. As a structural element of nucleic acids and a component of adenosine phosphates, phosphorus is important for energy transfers, and helps to move sugars from leaves where they are produced to fruits and seeds. Potassium is mainly important for cell extension and stomatal opening and closing, it also supports disease resistance and water-use efficiency within plants.

Optimally, a healthy soil diet is supplemented by the three **intermediate nutrients** sulfur, calcium and magnesium required in medium quantities, and the nine **micronutrients** boron, chlorine, copper, iron, manganese, molybdenum, nickel, sodium, and zinc, required in minute amounts. These ingredients are not just a dietary fad but are critical for plants to function and develop. Micronutrient deficiency in soils can lead to human micronutrient malnutrition, and a shortage of any of the fifteen named nutrients can limit plant growth, lower yields, and decrease the nutritional value of our food

Doctors recommend low sodium consumption and a reduction of **salt** amounts in our diet. Most people consume too much salt, even though high sodium consumption can increase the risk of cardiovascular diseases. Cutting salt from the human diet plan is beneficial to our health, and again, the same applies to our soils. Their state of health is more and more threatened by the increasing salt concentrations found in soils worldwide. Salinization means the accumulation of water-soluble salts from sodium, magnesium and calcium in the soil that can happen naturally but is exacerbated through the use of mineral fertilizers for agriculture. Plant growth is highly limited on saline soils and in extreme cases salinization can result in a complete collapse of the soil system destroying plants and other living organisms, ruining the possibility of growing crops there.

Our ideal body pH is about 7.4, slightly alkaline. There are several alkalizing or neutral foods such as potatoes, lentils and most green vegetables that can reduce the negative health effects caused by a high body **acidity**. Just as an overconsumption of high-acid foods like sugars in our diet can be harmful to our health, high nitrogen and sulfur use in fields, deteriorates soil health. A soil diet with lots of acidifying ingredients, including fertilizers like these, lowers the soil pH away from the optimum for plant growth: for most crops this is between pH 6.0 and 8.2. Low pH makes toxic aluminum soluble and makes other the major soil nutrients important for plant growth unavailable for root uptake.

We can think of our own diet and apply the same principles when setting up a plant and soil diet plan. We prefer a balanced diet, not at least to enjoy all kinds of flavors and taste adventures, but to get an intake of the full range of nutrients. The soil needs variety too.

What's on our plate?

Unfortunately, many of our soils have been on a rather bad diet since the massive intensification of agriculture in the 1930's, called the Green Revolution. Increasingly, soils are getting crammed with junk-food like chemical fertilizers, threatening their total collapse. The trend of deteriorating soils globally is in urgent need of a solution because it is accelerated by global population growth, urban expansion, land use changes, and exacerbated by climate change and rapid human dietary shifts. Our diet is increasingly seen as central to environmental issues like soil degradation: what we put on our plates now determines our world's future.

Stephanie Reiter

To put it bluntly, if we follow current human dietary patterns and stick to unsustainable agricultural practices that harm our food producing soils, we won't have to argue anymore if the best, healthiest diet is paleo, vegetarian or strictly plant-based because our plates will be empty.

Stephanie is a Geoecologist, holding a M.Sc. degree from the University Potsdam, Germany. She is passionate about soils and curious to investigate the various interconnections within our environment. As a consultant for the Global Soil Partnership of the Food and Agriculture Organization of the United Nations she evaluates the GROW Soil Nutrient Testing Kit to provide Growers with a reliable tool to equip them to manage their soils in a sustainable and healthy way.

oliver moore
Food, farming, organics, environment: column @IrishExaminer; Communications arc2020.eu; PhD sociology; UCC's Cntr for Co-op Studies; Views mine RT not support!
Jun 6 · 4 min read

Part 2 | What Makes a Healthy Diet? How to be a Soil Doctor

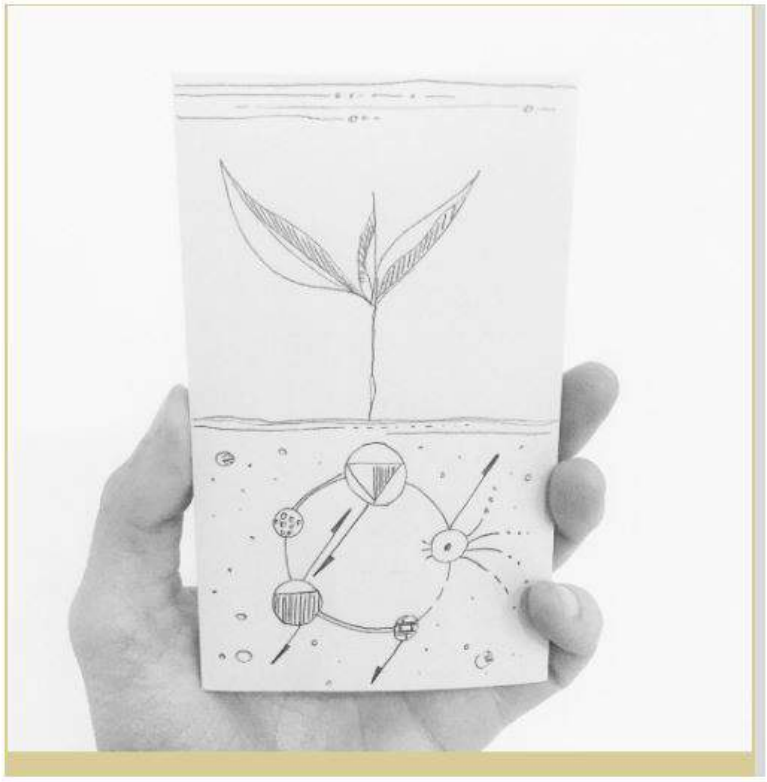


Photo and sketch by Stephanie Reiter

Part Two of a two parter by ***Stephanie Reiter (****Global Soil Partnership Secretariat)* ***and Lucrezia Caon (****UN Food and Agriculture Organization). Part one introduces soil, and a soil 'diet plan': part two, below, focuses on the things you need to do to be a soil doctor.*

Even a small adjustment in any diet can improve the overall state of health. Theoretically, we know the most important principles and ingredients when setting up a soil diet plan. Just like every human body is unique, so is every soil. Even healthy soils need a check-up, but sick or feeble soils need extra attention, in order to support plant growth or

meet our demands in food production. Getting some soil samples from our soils is the first step to become a soil doctor.

Read Part 1: What Makes a Healthy Diet—for people, plants & soil?

To know how to adjust a soil's diet, a basic testing of soil samples requires the three most essential plant available macronutrients nitrogen (N), phosphorus (P) and potassium (K), and soil pH. One way to test these soil chemical parameters is to use a soil testing kit. Off the shelf *NPK* soil testing kits are an easy to use tool, and can be purchased online or in retail garden centers.

Results for most *NPK* tests are given by a colorimetric method where the user compares the colour of a soil solution with the colour card corresponding to categorical nutrient levels (ranging from depleted to surplus), and pH levels (acid to slightly alkaline). With this information we can apply and plan our soils diet adjustments.

If a soil lacks nutrients, the best way to adjust the soil's diet is to foster nutrient recycling by increasing soil organic matter with crop residues or compost.

The application of fertilizers as a nutrient boost, aiming at promptly enhancing nutrient availability and crop growth, is a quick fix and hurts more than it helps in the long term. Mineral fertilization makes no improvement to soil structure compared to as adding organic matter: in many situations, farmers overuse fertilizers, harming soils rather than helping them getting healthy. Especially when a soil has a low pH, additional nitrogen and sulfur through fertilization, will lead to soil acidification. In this case, it is even more important to ensure a balanced fertilizer application, supplementing the soil diet with well-tolerated nitrogen fertilizers, such as nitrate-based instead of ammonium-based products, and apply alkalizing organic amendments such as lime or gypsum.

In general, constant monitoring and the overall application of sustainable agricultural management practices are the basics for a healthy soil diet.

The degradation of our soils is a world-wide epidemic. Our soils could be in better shape if only they were on the right diet.

The first step to get there is to understand and acknowledge that our current agricultural practices make our soils sick, but we need to make sure our soils are healthy to meet the rising global food demands and to provide us with nutritionally rich food.

Stephanie Rieter

A good start to any diet is a self-evaluation, so our soils too need constant monitoring of their conditions. Next is applying and following the principles that make a healthy soil diet. Then we can move closer to

achieving SDG 2 on Zero Hunger, with its emphasis on nutrition and sustainable agriculture.

We have the tools and are building the know-how to cultivate healthy sustainable agricultural systems that our soils and all of us will only benefit from.

Stephanie is a Geoecologist, holding a M.Sc. degree from the University Potsdam, Germany. She is passionate about soils and curious to investigate the various interconnections within our environment. As a consultant for the Global Soil Partnership of the Food and Agriculture Organization of the United Nations she evaluates the GROW Soil Nutrient Testing Kit to provide Growers with a reliable tool to equip them to manage their soils in a sustainable and healthy way.

GROW OBSERVATORY

Landscape representivity

MISKOLCI EGYETEM
UNIVERSITY OF MISKOLC

Landscape representativity

Environmental monitoring or landscape characterization require the selection and description of representative sites.

What does representativity mean?

- “Miniature of the population”
- “The sample has the same characteristics as the population”
- “The sample proportions are in all respects similar to population proportions”

What does representative mean for soil?

The soil properties, like moisture, nutrient content or temperature values of a certain site are valid for a larger neighborhood around the point, not just for the exact sample location.

microlow attracts water

microhigh is drier

Major factors affecting the representativity

LANDUSE

Different plants or different plant density use different amount of water and from different rooting depth

Soil surface with plant residue cover restrain water and lowers evaporation. Freshly ploughed soil with large and uncovered surface loose much more water by evaporation.

Higher vegetation may shade the neighbouring areas.

Shaded areas warm up later and evaporates less water. Look at the frosted soil surface in the shade while the rest of the area is already melted.

Major factors affecting the representativity

SOILTYPE

Soil has high spatial variability, often visible on the surface. The different colours on the aerial photos and satellite images refer to different properties, like soil texture, structure, organic matter content. These properties have a great impact on the soil porosity, which defines the infiltration, water holding capacity and conductivity. The higher organic matter content creates better structure and better water holding capacity.

Soil texture, structure, organic mater content has a great impact on the soil porosity, which defines the infiltration, water holding capacity and conductivity

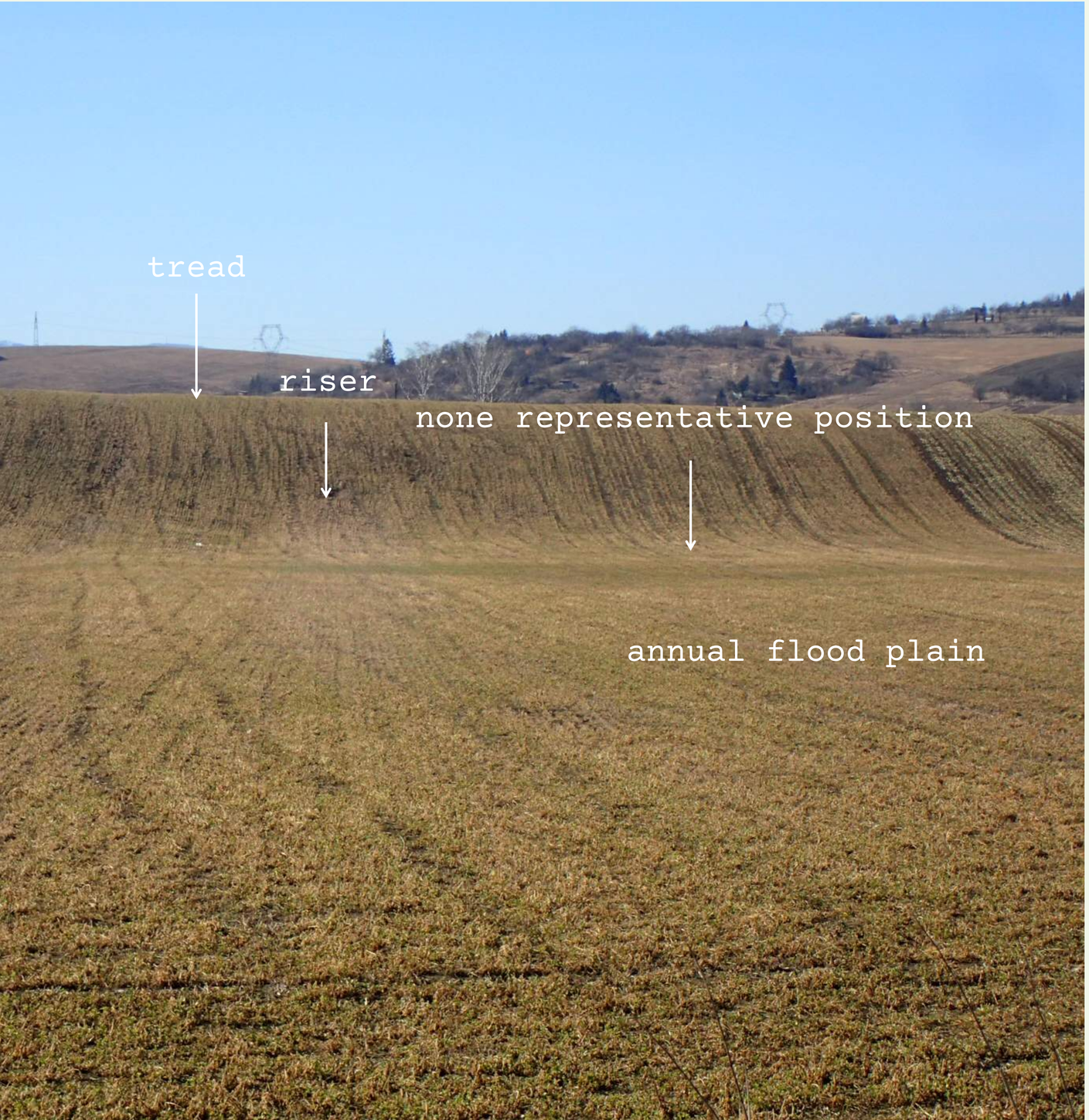

Organic matter rich topsoil
clayey soils
lighter color, lighter texture soil material


lighter color,
lighter texture
soil material
Organic
matter rich
topsoil
clayey
soils

none representative,
eroded crest position

Landscape position

Water moves along the surface following the gravitational forces. Sloping land has less infiltration and higher runoff. Lower section of the slopes may get extra water supply from the upper parts and dries out later.



Small landscape units are often included into larger landscape element.

In this terraced landscape there is an older terrace plane, the so called tread, and a lower lying annual flood plain. The two units are separated by a small sloping area, called risor. All three units have to be handled separately. Small intrusions are often neglected in the sampling, these areas are considered none representative to the larger area.

Anthropogenic activity, infrastructure

Human activity can alter the soil properties and the water movement. Heavy traffic, intense soil tillage destroy soil structure, decrease porosity and water holding capacity.

Roads serve as artificial dikes and may pond water

Make sure to get as far from the field edges as You can! Bordering area has always transitional character.

The closest location to the centre of your area the less chance to have disturbance from the neighbourhood

Never sample your soil next to the storage sites of manure, straw, fertilizer or any material used for soil melioration

Never sample your soil next to the storage sites of manure, straw, fertilizer or any material used for soil melioration

Never sample your soil next to the road, water channels

GROW OBSERVATORY

Anatomy of a Soil Profile (draft/more content to add)

The soil properties, like moisture, nutrient content or temperature values of a certain site are valid for a larger neighbourhood around the point, not just for the exact sample location. A soil profile can tell you more.


20
40
60

oliver moore
Food, farming, organics, environment: column @IrishExaminer; Communications arc2020.eu; PhD sociology; UCC's Cntr for Co-op Studies; Views mine RT not support!
Sep 19 · 4 min read

Handy Tips To Know Your Soil Type and Soil Texture

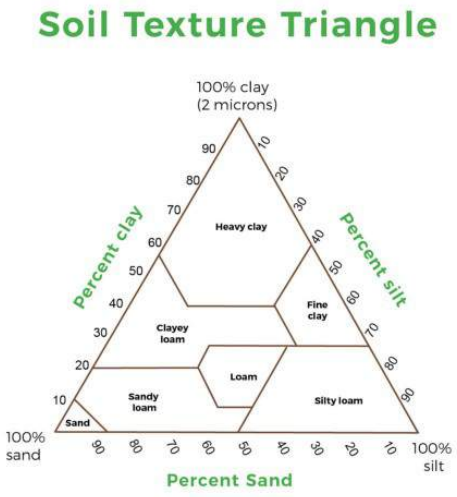
Notes on soil type taken by Tatjana Tupy of GROWPlace Austria at a recent event in LebensGut Miteinander

How do different soil types roll—in your hand? Do you know your sandy loam from your fine clay? And what does it all mean for your growing practices? Victoria J. Burton helps us better understand the stuff we stand on.

Soils are composed of mineral (tiny pieces of rock) and organic (plant remains) components. Depending on your soil type this can be nearly all mineral e.g. very sandy soils, or nearly all organic material e.g. peat. Soil texture refers to the relative amounts of three mineral particle sizes: sand (the largest), silt and clay (the smallest). The diagram below shows the relative sizes of these particles.

In a laboratory soil texture is measured by passing a sample of soil through a series of sieves with different sized meshes then calculating what proportion of the soil sample comprises the three different particle sizes. A soil texture triangle can be used to classify the soil

texture depending on the proportions of each particle size. Each country has a slightly different classification system with different names for each soil texture. The soil texture triangle below uses the Food and Agriculture Organization (FAO) classification as it can reliably be determined with a simple hand texturing technique. Knowing your soil texture is important as it influences water drainage, nutrient levels and susceptibility to erosion.



Measuring Soil Texture

Use this guide to determine the soil texture in your growing space.

You will need:
- Gardening gloves to protect your hands
- Trowel to collect the soil
- Ruler or measuring tape to measure the correct depth

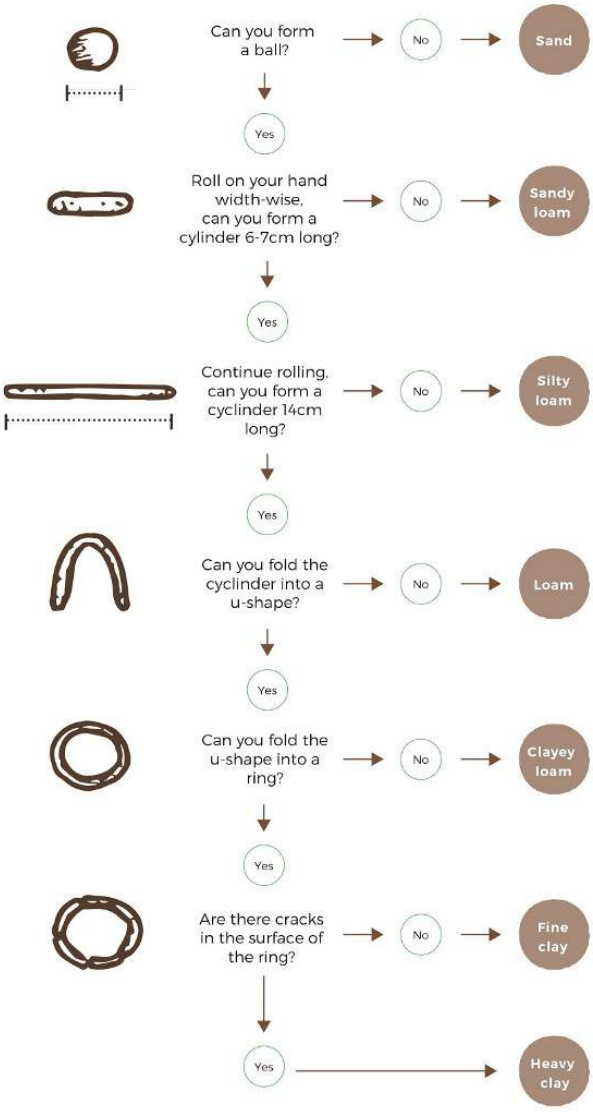
Dig a hole to 15 cm depth using your trowel—use your ruler or measuring tape to measure the correct depth. At 15 cm from the surface push the trowel into the side of the hole to take a sample at this depth.

Once you have collected your sample, break up the soil with a spoon or your fingers, and remove any stones, gravel, and large organic matter like leaves or roots. It is best to wear gardening gloves for this part to protect your hands.

Hand Texturing Test

Watch our short video outlining the process of assessing your soil texture

Manipulating soil in your hand and observing what shapes you can form gives an estimate of soil texture. To begin the hand texturing test take a handful of soil and add water until the soil begins to stick together without sticking to your hand, kneading the water and soil between your fingers and palm. Now follow the flowchart below to determine your soil texture.



Soil Textures

Sands

Sandy soils have large particles and gaps between them so can be difficult to grow in as they dry out quickly and nutrients are washed away quickly. However they do warm up quickly and are easy to dig.

photo via Soil-Net CC BY-NC-SA 2.0 UK

Sandy soil

Loams

Loams are ideal for growing food as they have a good balance of smaller and larger particles, which means they have space between for air and water (most plant roots need both). Water does drain in loam soils, but not too quickly, so they do not get too wet or too dry, and hold nutrients well.

photo via Soil-Net CC BY-NC-SA 2.0 UK

Loam soil

Clays

Clay soils can get waterlogged as the spaces between the particles are so fine that water cannot penetrate—plants will die if their roots are underwater for too long. Clay soils are particularly vulnerable to compaction—walking or machinery squashes the particles together which increases the risk of waterlogging. Avoid walking on clay soils, especially in wet weather, or spread your weight by resting on a board. When clay soils dry out they become very hard which makes it difficult for plant roots to penetrate them, and water tends to run off the surface. Clay soils take longer to warm up in spring and can be difficult to dig but on the positive side usually have good nutrient levels.

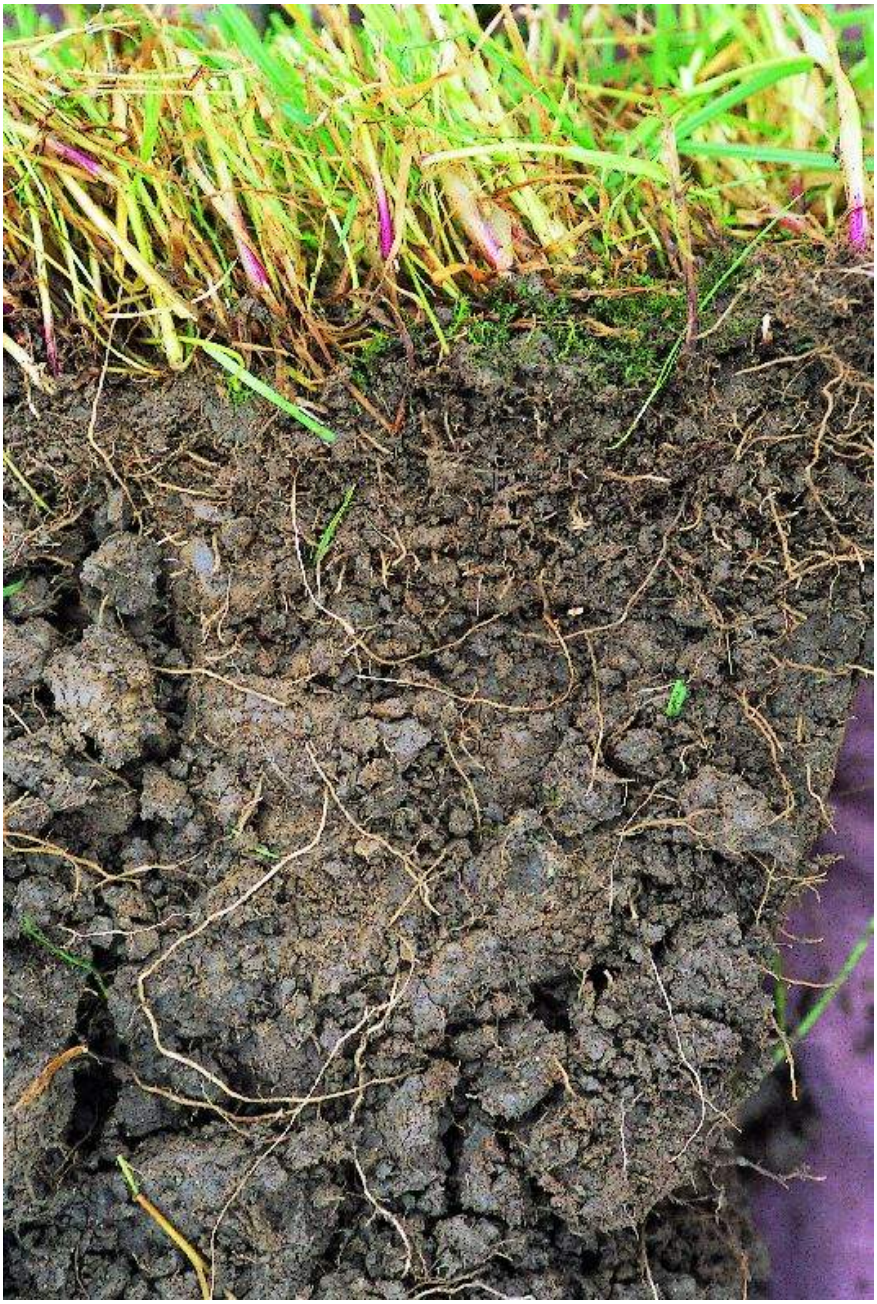


photo via Soil-Net CC BY-NC-SA 2.0 UK

Clay soil

Working With Your Soil Texture

Soil texture is very stable and can be difficult to change directly except by adding sand, so it's best to choose crops that grow well in the soil you have. Root vegetables such as carrots and parsnips grow well in soils with more sand and nutrient-hungry plants such as brassicas grow better in soils with more clay. Both sandy and clay soils can be improved by adding more organic matter such as farmyard manure or compost, which creates a more open soil structure, soak up and retain water and nutrients. You could build up organic soils above your existing soil through 'no dig' gardening methods.

Dr. Endre Dobos (L) and Volkmar Geiblinger (R) discussing soil profile at the recent GROWPlace Austria event

How do soil texture and stone content affect changes in soil moisture?

Soil moisture is a key indicator of soil health and plant growth. Soil moisture measured at the global level can be used to determine episodes related to climate change such as heat waves and droughts. Variations in soil moisture have a direct effect on the water cycle by affecting surface and subsurface runoff, which in turn impact natural vegetation and rain-fed agriculture.

- When it rains or when you irrigate your growing site, the pores in the soil fill up with water. The amount of water absorbed depends on the soil texture and structure, as these characteristics greatly influence the process by which water on the ground surface enters the soil (water infiltration), how water moves through the soil (permeability), and how water is held in the soil (water-holding capacity).

- Soil can retain water in two ways: in the pore spaces between, and as a thin layer around the soil particles.

Soil texture

SOILS ARE COMPOSED OF MINERAL AND ORGANIC COMPONENTS. SOIL TEXTURE RESULTS FROM THE RELATIVE COMPOSITION OF THE FINE MINERAL COMPONENTS OF SOIL - THOSE LESS THAN 2 MM ACROSS.

There are three particles that make up soil texture and their relative proportions give the overall soil texture. These are:

- Sand (the largest),
- Silt
- Clay (really fine particles).

When they are fairly equally represented, the soil texture is loam.

- Loam soils are ideal for growing food as they have a good balance of smaller and larger particles which means they have space between for air and water (most plant roots need both); water drains through but not too quickly, so they don't get too wet or too dry and they hold nutrients well.

- Soils that are very sandy drain really quickly washing away nutrients as well as drying out quickly.

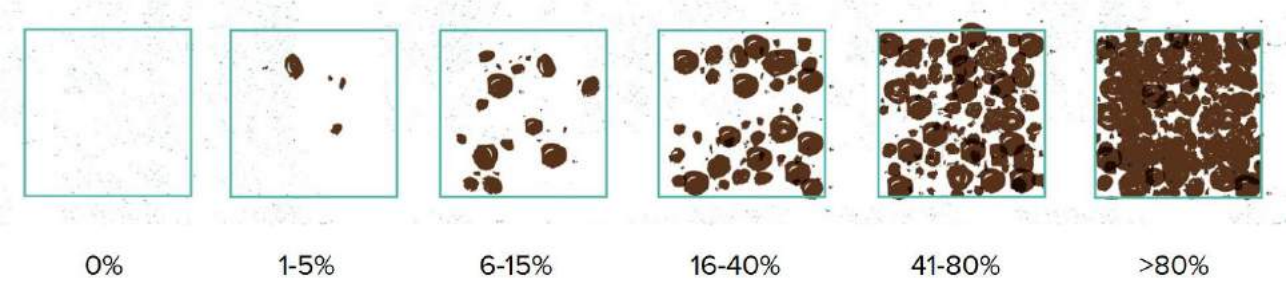
- Soils that are heavily clay can get waterlogged as the spaces between the particles are so fine and the clay particles can form an impenetrable layer. Plants will die if their roots are underwater for too long. When clay soils dry out they can become very hard and extremely difficult for plant roots to penetrate, making roots susceptible to breaking when this happens.

Soil texture can change a lot over a fairly short distance which is why it is vital for you to take the soil texture test right beside your sensor (15 cm apart)

Stone content

- Gravel and stones are also important mineral components of your soil. They both result from the weathering and transformation of larger rocks (also called parent material).
- Unlike fine earth, accumulations of pure gravel and stones are usually not capable of holding water or other mineral or organic matter important for plants and soil life.
- Nevertheless, gravel and stones in soil can strongly influence important soil properties. The more stones you find in a given amount of soil, the less fine earth you will have, which can then hold less water or soil organic carbon. On the other hand, stony soils increase water infiltration and thus improve water drainage from the surface, which in turn reduces soil erosion on the surface during heavy rains or floods.

The diagrams below visualize different percentages of approximate stone content, from 0% up to above 80%. The diagrams should help you *approximately assess* stone content as it takes some time to get very precise measures.



How-to-guide: Soil Survey

THE SOIL SURVEY IS A HANDS-ON ACTIVITY AND REQUIRES A FEW HOUSEHOLD ITEMS AND TOOLS TO DETERMINE SOIL TEXTURE AND STONE CONTENT. PLEASE MAKE SURE TO READ THROUGH THE GUIDE FIRST SO YOU ARE READY TO GO ONCE YOU HEAD OUTSIDE!

DURATION

The soil survey will take about 45 minutes in total, spread across 1-1½ weeks time.

THE SOIL SURVEY HAS TWO MAIN PARTS: ONE IS DONE OUTSIDE AND ONE INDOORS OR AT A LOCATION OF YOUR CHOICE.

EQUIPMENT

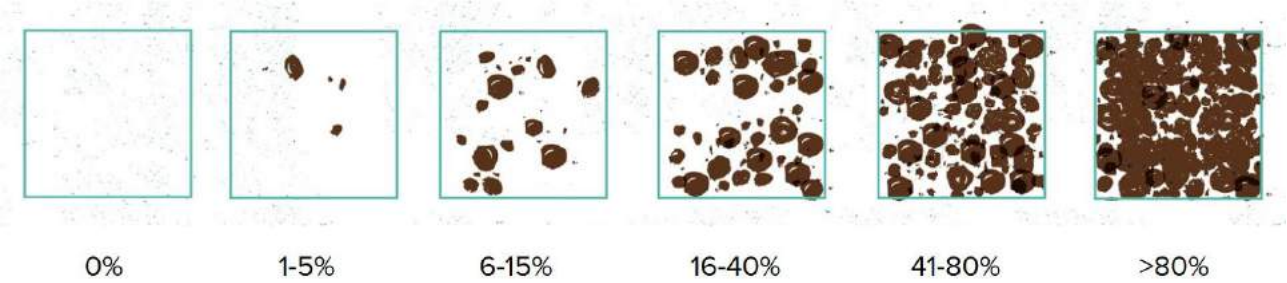
- Timer/stop watch (or timer on your mobile phone)
- Glass jar with lid: min. 13 cm tall, 8-9 cm in diameter
- Spade and/or trowel to dig and scrape
- Sieve (2mm)
- Fine permanent marker pen
- Piece of paper
- Tablespoon of Sodium hexametaphosphate (SHMP) (supplier recommendations needed)
- Water to fill the jar
- Tape measure or ruler for measurements
- Mortar (might be useful if you have heavy clay soils)

STONE CONTENT

Duration: 10-15 minutes

---

1. **Dig a hole** about 15-20 cm in diameter and 10-15 cm deep, **take out the soil** and set aside.
2. **Cleanly cut one side of the hole** with the spade or trowel so that it is smooth and evenly vertical, like a wall.
3. Gently **clean the wall with your hands** so that potential stones become visible.
4. Use the diagrams below to visually estimate the volume of stones in your observation pit. You can also examine the amount of stones in your soil visually and by touching on your hands, and once you sieve the dry soil (see next steps to measure soil texture), which will allow you to better recognise the presence of small sized stones. Please remember, these are approximate estimations, no exact measures, and that's okay!



5. Please note down your stone content estimation and record with the soil texture results (see below).

SOIL TEXTURE

Duration: 30 minutes to prepare, plus soil drying (if required), 3 days to dissolve soil, settling times (min 24 hours but might be longer depending on soil composition)

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1. **Take** a large enough soil sample from the dug up pit, from between 5-15cm depth.
2. **If necessary, dry the soil** (this may take a while)**.**
3. **Find a suitable glass jar** (min 13 cm high and 8-9 cm in diameter). Put a 3 cm soil mark from the bottom and a 13 cm watermark at the top.
4. If you have heavy clay soils, you will have to break apart the dried up soil. You can use a mortar, but **please be gentle!** Carefully break the compacted soil apart. **DO NOT grind or crush stones and sand particles to smaller pieces**.
5. **Use a 2mm sieve to remove debris and stones** bigger than 2 mm wide **from the dry soil** sample.
6. **Fill your jar** with the dried soil up to the 3 cm mark. Make sure the soil is very well compacted so there are no air pockets.
7. **Fill with water up to the 13cm mark and use the spoon to steer the solution until the soil dissolves.**
8. **Add a teaspoon of Sodium hexametaphosphate (SHMP), close the jar and firmly shake.**
9. **If organic debris collects at the surface, remove it with the spoon.**
10. Screw the lid back on tightly. **Shake your jar firmly again**. The soil needs to completely dissolve in the water.
11. Take the jar indoors and let sit for 3 days and shake firmly at least twice a day (morning and evening).

During that time, and after shaking the jar each day, you can already observe how the different soil components settle with different speeds. You can, for example, *slightly* tilt your jar backwards to better see the line between the first layer to settle (sand) and the other particles which still remain dissolved in the water. You can also rotate the jar horizontally to better see the line between the settled layer and the remaining soil solution. This can already give you an idea of how your soil settles before you do the final readings.

The next step is to record the different layers of soil texture, which, as you have been observing over the days, will need different times to settle. It will take about:

- 3 minutes for sand to settle (first reading),
- 5 hours for silt to settle (second reading), and
- a minimum of 24 hours or until the water clears for clay to settle (third reading). The third reading might take a few days.

1. After 3 days of dissolving the soil completely, **shake your jar firmly again.** If your jar is taller than 13 cm and you have a pocket of air at the top, try to get most of the soil into the water, so none of it sticks to the jar inside.

2. **Leave the jar to stand** for 3 minutes. Mark where the sediment has settled up to. This is your sand layer. Label ‘sand’ on the jar.

3. **Leave the jar on a flat and even surface where it can stand undisturbed while the next sediment layer settles.** Put it on a table or higher surface and leave for further settling.

4. **After 5 hours take the second reading on your soil texture jar.** This is your silt layer. M**ark the new level of the settled sediment** and label ‘silt’.

5. **Leave the jar on the flat and even surface. Check the jar after 24 hours.. If the water is not yet clear, wait until it clears. Make sure the jar remains undisturbed.**

6. By now, the silt layer might have settled more densely. If the layers are visually distinguishable, you may correct your line mark for silt.

7. **Once the water has cleared completely,** make your last mark where the last sediment layer has settled. Label this line ‘clay’.

8. Measure the different sediment layers with a ruler:

    - Sand layer from the inner bottom of the jar to the sand mark in millimeters.
    - Silt layer from the sand mark to the silt mark in millimeters.
    - Clay layer from the silt mark to the clay mark in millimeters.

Appendix 2: Garden and Allotment Holder Information Pack: “GROWing for All Ages”

GROW OBSERVATORY

GROWing for All Ages

A GROW Observatory Info Pack

Contents

Note: This is an example of an info pack for Deliverable 2.2. Some of the content for this info pack are in final production as of 20/10/2018, but will be in the final info pack.

Ways to engage with GROW OBSERVATORY

Keep in touch with GROW through social media and our e-newsletter

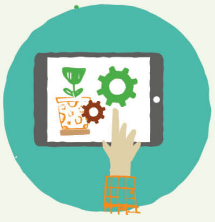
Register for our next online courses

Connect with other growers from all over Europe

Interact with the GROW online community

Be inspired with films and stories on soils, growing and satellites

Sign up to future observations and learning



Discover data and insights from our first citizen scientists' observations

Find out more: growobservatory.org @GROWobservatory

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 690199

GROW Observatory
Let's collaborate to grow great food, improve our soils, and help science with vital environmental monitoring. Get involved! http://growobservatory.org/
Sep 4, 2017 · 4 min read

GROWing Roots—with time, talking and tactile experiences

by Edith Salminen, Gro'up, Malmö, Sweden

For the month of September, GROW Observatory is highlighting the stories of GROWers—people with whom we have interacted and who inspire us, and who grow food, but also are interested in data, citizen science, policy, tech and more.

I decided to start growing two years ago, when I realised that if I wanted to practice my work as a gastronome in the right way, I also needed to get hands-on experience on growing food. I had an outsider's perspective, but that was not enough. I wanted to experience growing, to observe and understand nature, smell the soil, touch the land, connect with the seed in order to understand the whole cycle.

Growing helps you reactivate your senses and instills within you an attitude that gradually changes your life. I was impatient at first. Worrying about the amount of time needed and how slow things were moving. After a while, however, I realised that I could not control time; nature was calling the shots and I had to follow her rhythm.

> *"Adopt the pace of nature: her secret is patience."*
> *— Ralph Waldo Emerson*

When my partner farmer and I first decided to grow food, we hesitated because we felt the older, established farmers would question our true intentions. Growing is something of a trend, the new and cool 'hipster' thing to do. "Let's see how long you will last," some said, mildly chiding us city folk with our soft, unweathered hands. For them, we

represented a generation perhaps lacking the strength and endurance required to be real farmers.

As new city folk starting to grow in the countryside, we decided it was extremely important to create bonds and build trust between us and the older generations who have been farming long before us in the area. We felt it was not about aesthetics or techniques, but, rather, longevity: it was more about convincing older farmers that we were still going to be here next year, and the year after that. The whole first season was dedicated to establishing trust and breaking down misleading ideas about city people coming to the countryside.

I think it is very important to involve older generations in whatever it is that we're doing with our plot of land. I do this by asking for their advice, even if I think I have a reasonable idea of what the answer might be. It creates a bond between us, a sense of community which is immensely valuable. If I have a problem and I spot an older farmer walking by, I immediately ask him for help and advice. Suddenly, we

are four people standing around a problem and I realise that there's so much more than just a simple answer to my question. This is priceless!

What is GROW Observatory? And where did it come from?

In my opinion, GROW offers a great opportunity to highlight the need for this inter-generational connection, to promote knowledge sharing, and help break any physical or mental walls between rural and urban people. I'm aware of this being an ambitious goal and creating such bonds don't happen overnight. As far as I am concerned, the main point is how to combine the slow-paced, manual lifestyle of growers with the digital and hyper-connected world we live in today. If GROW is successful in doing this, then it would be something revolutionary!

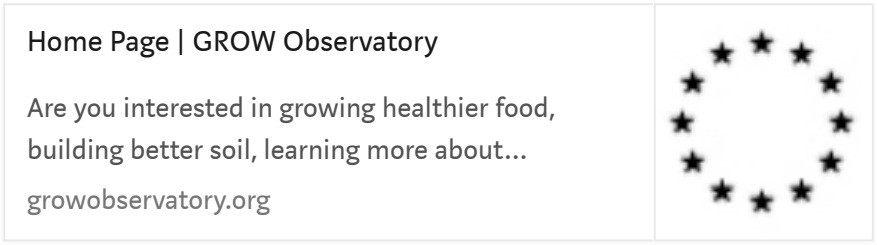
In order for an online information hub to work successfully though, real encounters and stronger mental and physical relations between urban and rural people need to be established.

We are people, and people feel connections when they experience real things—until something moves in their hearts. People react to things that move them emotionally. We need to start feeling the countryside, it needs to move us from within. And vice versa, the countryside needs

to start feeling the city, too. We need to create relationships built not on necessity, but on emotions and empathy. Only then, will these two seemly opposite parts start interacting and interconnecting in a deep and meaningful way.

Finnish born but international at heart, Edith Salminen is an eclectic food professional: a food culture specialist, a holistic gastronome and a small-scale amateur farmer. Where there's a food issue of any kind, Edith is there to observe it, analyse it, process it and hopefully to solve it. Today Edith is co-founder and manager of Gro'up—Malmö's first community food space where food is used as a social tool and a vehicle to drive change.

What is GROW Observatory?



oliver moore
Food, farming, organics, environment: column @IrishExaminer; Communications arc2020.eu; PhD sociology; UCC's Cntr for Co-op Studies; Views mine RT not support!
May 14 · 4 min read

GROW Place Ireland | Citizen Sensing in Community Gardens

Joanne Butler of OURganic gardens

By Davie Philip (Community Catalyst with GROW Observatory)

"A garden is a solution that leads to other solutions. It is part of the limitless pattern of good health and good sense." Wendell Berry

What are Community Gardens?

The popularity of community gardens—areas of land collectively managed by a group of people—has grown rapidly in recent years. These locations are fertile grounds for much more than just food production.

Working in a garden with others has positive effects on our wellbeing and are powerful places for building social ties, creating local connections and engaging with people at risk of exclusion. As well as wonderful places to grow vegetables, a community garden is an environment for growing stronger relationships.

Community gardens are great settings for learning about growing, composting, bee keeping, seed saving and other skills in self-relience, and even provide an outlet to better develop our teamwork,

communication and interpersonal skills. They can also nurture young people's development, providing many benefits including improved attitudes toward healthy food and an increased awareness of nature.

Importantly and interestingly from a GROW Observatory perspective, Community Gardens could be great places to enable people to act as citizen scientists, to observe soil, collect data and test new sustainable growing practices.

Community Gardens in Ireland and the GROW Observatory

Community Gardens Ireland or CG Ireland for short, is a support network, to promote the work of new and existing community gardens throughout Ireland and Northern Ireland. Their aim is to facilitate food growing while empowering local people, of all ages, backgrounds and abilities, to strengthen their communities.

CG Ireland have been selected as GROW Observatory 'Community Champions', and will be joining similar organisations from Portugal, the Netherlands, Luxembourg, Austria, Greece, Spain and Scotland to develop GROW Places, regional focus areas for citizen science where people will collect data that can help validate climate prediction models from satellites.

On the 27th of May 2018 CG Ireland will be hosting 'Our Soil', an event that acts as their annual gathering and the launch of GROW Places. (Scroll down to see this exciting event on the Convergence festival page).

All the community gardens, farms and growing places that will be invited to join the Irish GROW Places will help to increase people's knowledge of soil. Using affordable sensors, they will collect data that can help validate climate prediction models from satellites. The first Irish GROW Place will be in the north west of Ireland—in county Donegal—with another in the South East to follow.

Joanne Butler from the Community-led Social Enterprise OURganic Gardens is from the Donegal GROW place:

Joanne Butler (right) with Tansey Watson (left) at the Electric Picnic Music Festival

"Well first things first When I signed up on the first GROW Course 'From Soil To Sky' I noticed where I am growing is one of the most north westerly locations in Europe and the idea that we could take part in such a fantastic opportunity was very exciting. I have been part of community gardens Ireland for five years now and I love the benefits that networking, communicating and sharing knowledge has for all, which is exactly what the GROW project is all about. And now to be part of the GROW places in Donegal—working with community gardens, helping develop our projects some more is wonderful—I'm really over the moon!

When it comes to the importance of our Soil, as a grower I totally understand why we need to look after the soil below our feet and to explore new ways to protect it in this ever changing climate.

Bringing people together as citizen scientists will help us not only collaborate together and share knowledge on a much wider basis, but help us take a new look at the world and see how we can all play a part in making a difference!"

To reverse further degradation of soils we urgently need increase participation in the stewardship of our land. With access to on-line courses and educational resources for participants, the GROW Place project supports the emergence of a movement of citizens sharing knowledge and data on soil. These 'citizen scientists' will help with forecasting and preparing for climate events, such as heat waves and floods, by validating the detection of soil moisture from satellites as well as taking practical steps to preserve the soil for future generations.

Community Gardens Ireland travel to the Electric Picnic with Cultivate each year, where they co-create the GLobal Green area. Here's a short video from 2015

GROWers having an Eclectic Electric Picnic in the Irish Midlands

Concluding our monthly theme GROWers—the people of GROW—we meet Davie Philip. In fact,...

medium.com

More information on GROW Places can be found under the GROW Places tab on our Medium page.

Testing Acidity & Alkalinity of Soil

**with bonus experiments in lemonade!*

GROW OBSERVATORY

The acidity or alkalinity of soil, measured on a scale called pH, is fundamental to many soil functions including microbial activity, uptake of nutrients and plant growth. Testing the pH of your soil is a first step to understanding which plants might grow well there. In nature, different soils have different pH levels depending on their parent rock and the conditions under which they they have developed. For example, chalk soils and those from limestone rocks tend to be alkaline (high pH of 8-9) whereas those that develop over granite and in wet conditions tend to be more acidic (low pH around 4-5). For gardening, we tend to prefer soils that are neutral - around pH 7 - as these suit a wide range of food plants.

How do you find out what pH your soil has?

You could use litmus paper which changes colour depending on the level of acidity or alkalinity in your soil. Or you could make your own pH indicator from red cabbage (and then make lemonade)!

Soil testing with indicator paper

Field scientists use a pH meter to test soil pH. Although these give a good level of precision, they can be quite expensive. Indicator paper - often called litmus paper or pH strips - offers a cheaper but reliable way to test soil pH. You can usually buy a few hundred strips cheaply. The strips are placed in liquid and change colour in response to acid or alkaline conditions according to the colour scale provided.

1. Take a handful of your soil, removing any large stones or debris, and place in a clean container.
2. Add water - ideally distilled water which has a neutral pH of 7 so won't affect your reading. If not, then use rainwater since this is what falls on your garden anyway. Add a cup full of water so that your mixture is runny.
3. Leave the soil and water for 30-60 minutes.
4. If you have one you can use a coffee filter to separate the liquid from the soil particles. If you don't have one, you can rinse the soil off your strip in the next step using distilled or rain water.
5. Dip a pH strip in the soil liquid for 30 seconds and then match the colour against the chart provided with it to read your pH. [Note that the colour may change if the strip dries out].

TIP

You can also use a pH strip to test your rainwater alone. If it is more acidic than your soil sample, your soil might be slightly more alkaline than you think.

Making your own indicator

Red cabbage water is also a pH indicator that changes to different colours depending on the alkalinity or acidity of a substance.

1. Use some of the red cabbage leaves that you have discarded when cooking; 2-3 leaves chopped up, should be plenty. Boil them in a cup or two of water - enough to cover the cabbage leaves - for about 5 minutes. Don't let it boil dry.
2. Allow the cabbage water to cool completely (about 15 minutes)
3. Put your soil sample(s) into small containers - as many as you want to do tests with. White or clear ones will allow you to see the colour more easily. Small bottles or dishes will be fine. Keep an empty one for the cabbage water by itself so you can compare the colour.
4. Add a dessert spoon of the red cabbage water to your soil sample, stir and leave for about 10 minutes, then check the colour change (it might happen more quickly, depending on the pH).
5. If it goes pink, your soil is acidic, if it goes blue-green, it is alkaline.

TIP

You can try this with other plant indicators like beetroot, blackberries, raspberries, copper beech leaves, or onion skins.

If you have pH papers or red cabbage indicator left over, you can:

- Test different areas of soil in your garden to see if the pH varies
- Test the reaction for known acids like lemon juice or vinegar and for known alkalines like soap and sodium bicarbonate (sold in food shops as bicarbonate of soda or "baking soda")
- Share them with your friends, family and neighbours so they can test their soils

INGREDIENTS:

1. Lemon
2. Lavender flowers, leaves or dried
3. Sugar
4. Water

Making colour-changing lemonade!

After all that hard work, here's a fun little treat you might enjoy. If you make lemonade with lavender, you can see for yourself what happens when an alkaline liquid meets an acidic liquid. The colour change works best with lavender flowers, but also works with lavender leaves and dried lavender.

Steps:

Note: All amounts are approximate; when we made it, we reused pickle jars (about a litre). Vary the quantities based on how sweet, tart or flowery you would like the lemonade to taste.

First, collect lavender flowers, leaves and/or dried lavender - about 18 flowers, a few stems of leaves or a couple tablespoons of lavender. Place them in the jar, and pour over boiling water until the jar is half full. (You are essentially making lavender tea.) Add sugar to taste - start with 85 g and add more if you need it. Let this cool as you prepare the lemons.

Juice your lemons. Four lemons should make about 200 ml of juice. Add the yellow lemon juice to the blue/green lavender liquid - suddenly it turns pink! This is the result of the alkaline lavender water meeting the acidic lemon juice.

Put this in the refrigerator to cool, and enjoy after a long gardening session in the sun!

This project has received funding from the European Union's Horizon 2020 research and innovation programme 2014-2018 under grant agreement No. 609199

Make an Earthworm Hotel

See what difference earthworms make to the soil

**because even earthworms like a holiday!*

GROW OBSERVATORY

Earthworms, also known as soil engineers, are one of the key soil organisms for improving soil structure and fertility. They help to decompose organic material by dragging it down into the soil and unlocking its nutrients through digestion; the nutrients are excreted in earthworm casts (faeces). Not only do earthworms help to make soil more fertile, but their burrowing habits alter the physical structure of the soil – opening up small spaces known as pores. This leads to an increase in water infiltration, bringing water and water-soluble nutrients down to the plant roots. This extra space also allows for the soil to hold more air, which is important for plants and organisms within the soil

Why an earthworm activity?

Earthworms are a great example of how something small and seemingly insignificant can have a huge impact on our soils. We are going to look at this first-hand through a simple and fun activity.

What you need for this activity

For this activity you are going to have two containers – a control container and a treated container. Both containers will be filled with compost, but one of them will have added earthworms (your treatment) and one will not (your control). For example, in this activity the control container will go through all of the same procedures as the treatment container, but it will not have worms added. This will allow you to see the difference that the worms make to the soil by comparing it with the control.

You will need:

1. 2 x 2l plastic bottles
2. Scissors to cut the tops off your bottles and add holes to your cling film
3. Gravel to put in the bottom of your bottles
4. Sand to create layers
5. Compost, you need enough to fill both bottles
6. Food scraps to feed your worms
7. A spray bottle of water to moisten your compost
8. 2-3 earthworms to add to your treatment bottle
9. Food wrap to cover your bottles
10. Dark paper to cover your bottles

TIP

A control is something in an experiment that goes through all the same procedures as a treatment, but does not receive the treatment.

Instructions

1. Prepare your bottles: Cut the tops off two plastic bottles and label them. Label one "control" and the other "earthworms". (Photo 1)
2. Gravel: Add 2 centimetres of gravel to the bottom of your bottles.
3. Compost and sand: You need to fill your bottles with compost. Add several layers of sand of approximately 0.5cm thickness throughout the bottle. You want them to be thin layers, but also visible from the outside of the bottle. As you add the compost, moisten it with water from your spray bottle. You do not want the compost to be dry, or saturated.
4. Find some worms: Find 2 to 3 earthworms by digging around in your garden, or somewhere where you have permission to dig. Add these worms to your designated "treatment" bottle.
5. Add food: Add a layer of vegetable food scraps to the top of your compost in each bottle. This is what the earthworms will eat. (Photo 2)
6. Cover the bottles: Cover the top of your bottles with food wrap. It is crucial that you add holes to it (try using a pencil or scissors) because earthworms need air. Tape dark paper around the sides of your bottles. Earthworms dislike light. You can take this off to observe your worms, but put it back on afterwards. (Photo 3 and 4)
7. Store your worms: Keep your worms away from direct sunlight. A dark cupboard would be perfect.
8. Water your worms: Add two teaspoons of water to your soil each day to keep it damp. If it is looking dry, add a little more.
9. 2 weeks later: After 2 weeks, take the black paper off both of your bottles and observe the difference. There should be a big difference!
10. Return your worms: Return your worms to where you found them so they can continue to improve the soil!

photo 1

photo 2

photo 3

photo 4

TIP

When doing experiments, it's important to record what you discover. This is your data. For this activity, you might take photos of your Earthworm Hotel each day to record what changes you can see. You might also keep track of how much food you give them, and any other interesting observations.

Recording data is an important part of being a citizen scientist!

This project has received funding from the European Union's Horizon 2020 research and innovation programme 2014-2018 under grant agreement No. 609199

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