

V1

D6.1 – Practice abstracts: 1st batch (52)

ADVISOR NETWORK FOR OPTIMAL FERTILISERS USE

Document Summary

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Abstract

The **STRATUS** project has so far delivered **52 Practice Abstracts** (PAs) to disseminate the Good Practices (GPs) and Research Innovations (RIs) identified during the project in a simple and easy to understand way. Practice abstracts have been created as a result of the GP and RI collection process and have been disseminated in the [EU CAP Network](#) website following the EIP-Agri Format. The PAs have been made available on the [project website](#) and on the [AdvisoryAgriHub](#) platform, developed jointly with other advisory projects.

This report contains a list of the first batch of 52 PAs, including the name of the practice and the country of origin, as well as the PAs themselves (Annex 1). Although only 30 PAs were planned on this first batch, 52 good practices and research innovations have been identified so far. All these have been used as the basis for the PAs included in this deliverable.

The PAs are organized around three themes aligned with the project's three thematic networks: **soil quality**, **precision farming**, and **bio-based fertilisers**.

List of Practice Abstracts

SOIL QUALITY

#	Practice Abstract	Geographical Location
1	Biochar as soil amendment	Sweden
2	Quality fodder – Quality manure – Quality soil	Belgium
3	Preventing and resolving soil compaction	Belgium
4	Possibilities of using biogas digestate plants as fertilizers and soil improvers	Croatia
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6	Crop rotation	Netherlands
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13	Split N application – for grain crops, dividing the dose into 2 or 3 split applications	Spain
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15	Manure mediation including digested sewage sludge	Sweden
16	Strip-till in sunflower crop	Spain
17	Soil passport or farm soil and waterplan	Netherlands
18	Cut and carry fertiliser	Netherlands

Table 1 List of soil quality practice abstracts

PRECISION FARMING

#	Practice Abstract	Geographical Location
19	Soilexact, the use of soil moisture sensors to optimize irrigation and soil moisture content	Netherlands
20	Advanced nutrient management using soil analysis and growth simulation	Netherlands
21	Zero spots method to optimize wheat nitrogen fertilization	Sweden
22	Use mobile apps and satellite images to identify fertilisation needs	Slovenia
23	Developing precise fertilisation plans with regard to VRA using satellite imagery and drones in maize and cereals	Slovenia
24	Fertiliser spread pattern measurement and spreader adjustment using collection trays	Belgium
25	Use of the online information platform WatchITgrow to generate task maps for variable fertiliser applications	Belgium
26	Cropsat – Free satellite imagery for tailored nitrogen fertilization in wheat	Sweden
27	Site specific estimation of winter cereals and rapeseed nitrogen needs via satellite	France

28	Prescription maps for variable rate fertilisation using crop vigor maps	Italy
29	Prescription maps for fertilizations in vineyards using 3D point cloud and AI algorithms on mobile device	Italy
30	Realtime measuring nitrogen content when applying animal manure to visualize uneven distribution	Netherlands
31	Site specific yield determination in potatoes to understand local nutrient needs and surpluses in crop residues	Netherlands
32	Precise fertilizer applications using software tools and satellite NDVI imagery in arable crops	Poland
33	Variable rate fertilizer application based on NDVI maps created with Sativum app in grain crops	Spain
34	NDVI-driven drone-based field analysis for precision nutrient management	Greece
35	Leveraging drone technology for fertilizer optimization in tomato and corn crops	Poland
36	Precision nitrogen management using historical yield maps and variable rate technology in grain crops	Spain
37	Leveraging drone technology for fertilizer optimization in tomato and corn crops (organic vegetable production)	Greece
38	Localized application of nitrogen and phosphate starter fertilizers when sowing maize	France

Table 2 List of precision farming practice abstracts

BIO-BASED FERTILISERS

#	Practice Abstract	Geographical Location
39	Using and retaining crop residues	Netherlands
40	Cut & carry fertilisers	Netherlands
41	Pig slurry composition analysis	Spain
42	Managing nutrient availability rate from municipal sludge	Spain
43	Scrubbing of stable air to produce ammonium sulphate	Belgium
44	Stripping-scrubbing of liquid fraction of pig manure to produce ammonium nitrate	Belgium
45	Guaranteed level of nutrients manure products	Netherlands
46	Agricycling, regional usage	Netherlands
47	Solid fraction of a digestate from plant material	France
48	Use of digestate originating from small scale farm digestion	Belgium
49	Optimizing fertilization by using non-microbial biostimulants	France
50	The use of biochar in growing media for soilless cultivation in horticulture	Belgium
51	Fertibio – development of the production process of biofertilizers	Italy
52	Biochar, innovations through carbonizations tested in Amiata and Maremma	Italy

Table 3 List of bio-based fertilizers practice abstracts

Annex 1 – Practice Abstracts

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Biochar as soil amendment

Sweden

Biochar is used as a soil amendment due to its properties of storing water and nutrients. It is also a carbon sink and can thereby be sold as a carbon credit, giving the farmer an additional revenue stream. Biochar is applied on or in the soil, can be applied together or separately from manure, seeds or while otherwise working the land. There is no generally accepted limit to how much biochar can be applied, but in field studies around 8 tons dry matter per hectare is commonly used.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Soil amendments have been used on most soils and have included the addition of manure, straw or other organic matters. Nutrients have also basically always been added to agricultural lands but in the form of mineral fertilizers. Biochar takes the role of both these amendments, with the addition of being a carbon sink.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Climate change issues provided the opportunity to gain financially from producing biochar and selling the carbon credits. On-farm challenges of soil packing, lack of nutrients, lack of soil carbon, and the increased threat of drought backed the solution of using biochar as a soil amendment.

How long did it take to implement the practice and which are the measures needed to monitor? Same time as spreading fertilizer or manure. No monitoring needed for the carbon sink.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices -Soil Quality - BIOCHAR AS SOIL AMENDMENT

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Quality fodder – Quality manure – Quality soil

Belgium

Changing the crop rotation towards more grass (single, multispecies, with legumes) in a fodder producing agricultural system for cattle production will positively benefit soil quality by breaking monoculture (or dominance) silage maize, a crop with very low contribution to soil organic matter and changing to crops that have large contribution to soil organic matter (grasses). In addition, diversifying the crop rotation increases diversity and the possibility of having perennial crops is higher, which has an additional positive impact to soil quality, by less disturbance of the soil.

In addition, it is hypothesized that the manure produced by cattle fed by this shifted ration (from dominance silage maize to more grass-based) has a higher “quality” which would have positive effects on soil quality. Examples are an increased C/N ratio of the manure, more N in organic forms and a shifted microbial composition. This could lead to higher contribution of the manure to soil organic matter and changes in the soil microbial composition.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Fodder production with dominance of silage maize.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Regulations regarding NH₃-emissions in cattle farming. Some farmers indicate poor cattle health as a driver in changing the feed rations towards more grass.

How long did it take to implement the practice and which are the measures needed to monitor? Monitoring: characterisation of fodder composition in combination with manure and soil characterisation.

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Project Keywords

Links

STRATUS - Good Practices -Soil Quality - QUALITY FODDER – QUALITY MANURE – QUALITY SOIL

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Preventing and resolving soil compaction

Belgium

The prevention of soil compaction by reducing the load per cm² of soil and by taking care of the soil's carrying capacity is very important because the resolving of deep soil compaction (compaction just below the topsoil, 30-50 cm) is difficult. Resolving of deep soil compaction can be done by a combination of deep tilling, deep rooting crops and subsequent maximal prevention of recompaction.

Reducing the load per cm² of soil can be done by optimization of tyre size and pressure, by dividing the load over several wheels, by minimizing the total load as much as possible and by using semimounted machinery. In addition, the carrying capacity of the soil against compaction needs to be considered and this is much lower when the soil is wet and when it is freshly cultivated.

Deep tilling to resolve soil compaction needs to be considered carefully. After deep tilling, deep rooted crops should be cultivated and measures that ensure maximal prevention for re-compaction need to be taken. Deep tilling, when done careless, can result in even deeper and stronger compaction. The use of deep rooting crops only is likely not sufficient to resolve deep compaction.

Conservation tillage practices have less deep compaction.

In some cases, use of fixed field pathways via RTK-GPS navigation can prevent compaction in the remaining field, often done in intensive vegetable production.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? None

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Reduced crop yield in compacted areas.

How long did it take to implement the practice, and which are the measures needed to monitor? Farmers need to be aware of the risks of soil compaction when going into their fields when the soil is too wet and with too heavy loads. There is need for a mentality shift but there is also the need for adaptations on the tractors and the rest of their machinery. We estimate it will take 3-5 seasons to implement the practise with a new farmer. Farmers often know their "bad spots" in the field. In those spots, during wintertime, using a penetrometer (either digital or manual) can help investigate whether these bad spots are due to deep soil compaction. Deep soil compaction = compaction just below the top soil (30-50 cm). Use of a penetrometer should be done when soil is at field capacity, penetration of soil should be very easy then. Resistance against penetration can indicate soil compaction.

SOURCE PROJECT

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Project Keywords

Links

STRATUS - Good Practices -Soil Quality - PREVENTING AND RESOLVING
SOIL COMPACTION

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Possibilities of using biogas digestate plants as fertilizers and soil improvers

Croatia

Fertilizer trials will be set up on agricultural land OPGs on three crops in crop rotation/rotation: maize, winter wheat, and Italian ryegrass. Before setting up the experiment, soil samples will be taken in the planned areas in order to determine the initial state, and the analysis of the digestate that will be used in the research will be carried out. The second step will be setting up experiments and implementing all necessary agrotechnical measures. In accordance with the research plan, soil and plant samples will be continuously taken and analyzed material and perform all necessary measurements in the experiment. Yields per variant will be determined by fertilization and production costs and profitability for each variant of the experiment.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

[STRATUS - Good Practices -Soil Quality - POSSIBILITIES OF USING BIOGAS DIGESTATE PLANTS AS FERTILIZERS AND SOIL IMPROVERS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Bioashes for advanced agri-food production & soil fertility

Croatia

The utilization of bioashes in Croatia presents a valuable opportunity for sustainable disposal and agroforestry applications. These alkaline byproducts, derived from forest biomass plants, can effectively address the challenge of acidic soil ($\text{pH} < 6$) by enhancing soil fertility and reducing the need for mineral fertilizers and commercial conditioners.

At the beginning of the project, we analysis the needs and key goals were identified – to prove the usability of using ash from the biomass thermal power plant for the purpose of improving agricultural production and the fertility of agricultural areas on acidic and poorly supplied soils with P, K and other macro/micro-elements. Soil samples were taken from partner-managed plots for initial screening and analysis of pH, P, K, and humus content. Detailed pedological research was conducted on selected plots, including morphological analysis and physio-chemical laboratory analyses. A 2-year field experiment with bioash treatments was carried out, monitoring soil changes, microbiology, and crop yield. Over 400 soil samples were analyzed for physical-chemical and microbiological properties. Plant material was also tested for yield and nutrient content.

Through years of extensive research in both field and controlled settings, the project has investigated the impact of different bioash doses on physico-chemical and microbiological properties of acid soils, as well as the qualitative and quantitative parameters of agricultural crops. The project resulted in increased soil fertility and innovative products for soil amelioration, recognized with awards for sustainability and waste management.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Conventional agricultural practice, which include using of mineral fertilizers and pesticides.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Acidic and poorly supplied soils with P, K and other macro-/micro-elements.

How long did it take to implement the practice and which are the measures needed to monitor? A 2- year field experiment with bioash treatments was carried out, monitoring soil changes, microbiology, and crop yield.

SOURCE PROJECT

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Project Keywords

Links

STRATUS - Good Practices -Soil Quality - BIOASHES FOR ADVANCED AGRI-FOOD PRODUCTION & SOIL FERTILITY

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Crop rotation

Netherlands

Crop rotation is an important factor in maintaining and improving soil health. Continuously growing the same crop over multiple years can lead to an increase in soilborne diseases, as pathogens specific to that crop are given the opportunity to multiply. When a susceptible crop is repeatedly grown in a short amount of time, these diseases can spread more easily, reducing plant health and yield. Similarly, an intensive crop rotation of a limited number of crops can deplete the nutrient availability.

In contrast, a diverse crop rotation that includes a variety of plant species, particularly deep-rooted and cover crops, contributes to better soil structure and overall soil health. By alternating crops with different root systems and nutrient needs, farmers can reduce soil compaction, improve aeration, and enhance organic matter content. Including legumes in the rotation, such as clover, can increase nitrogen levels through nitrogen fixation. This is especially relevant in organic farming.

Furthermore, integrating crops with varying nutrient demands and decomposition rates helps balance nutrient cycling. Deep-rooting crops, for example, can access nutrients from deeper soil layers, which, after their residues decompose, become available to shallow-rooting crops. In addition, alternating between crops with different functions, such as leaf and root crops, not only diversifies nutrient usage but also reduces pest and disease pressures by breaking their life cycles, can contribute to weed control and spread the labour demands.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Depending on the region a rotation of 1:2 to 1:4.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Expanding the crop rotation is a systemic change in the farm management. It does not only change the machinery required, but also affects the profitability of the farm. Reducing the number of intensive crops might lower the financial profits but could potentially also lower the costs. Especially when the investment results in a higher yield per hectare in the year that the cash crop is grown.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Spain, Poland, Greece, Slovenia, Netherlands, France, Latvia, Hungary, Italy, Belgium, Sweden

Project Keywords

Links

STRATUS - Good Practices -Soil Quality - CROP ROTATION

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Cover crop mixing grasses and legumes

France

Between two main crops is sown a mixture of grasses – oats, rye, buckwheat, Moha – and legumes – often forage species, instead of bare soil. The cover crop is destroyed during its vegetative step before the seed formation.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Bare soils are still present during the winter period.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? To prevent soils from erosion and leaching thanks to the leaf and the root areas with the caption of a part of the mineral nitrogen still stored in the soil after the harvest. To fix soil structural issues like packing or slaking crust thanks to the root action and to the earthworms' activity improved by the organic matter provided by the cover crop. To maintain or increase the soil organic matter content and to balance the mineralisation impacts. To break the chain of parasites or diseases.

How long did it take to implement the practice and which are the measures needed to monitor? This practice needs two more interventions after harvest during the autumn and winter period. No specific measure to be taken.

SOURCE PROJECT

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Project Keywords

Links

[STRATUS - Good Practices -Soil Quality - COVER CROP MIXING GRASSES AND LEGUMES](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Reducing soil tillage / Simplified cultivation techniques

France

Simplified cultivation techniques are practices to reduce soil tillage, without use of ploughing. Their use allows to prevent from erosion and to improve soil biological activity, particularly earthworm presence. Simplified cultivation techniques gather deep ploughing (or ploughing without turnaround), crop itinerary with non-plough tillage but loosening, strip till, superficial tillage and direct sowing.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Conventional ploughing.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? This kind of practice can be needed because of issues of soil fertility like packing or plough pan. In a situation of wet and hot climate, ploughing may occur erosion. An intensive soil work decreases the content of organic matter of the arable layer by accelerating its mineralisation. A decrease of soil tillage may also improve the sustainability of the soil helper macrofauna.

How long did it take to implement the practice and which are the measures needed to monitor? About 3-5 years are needed to get effects.

SOURCE PROJECT

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Project Keywords

Links

STRATUS - Good Practices -Soil Quality - REDUCING SOIL TILLAGE /
SIMPLIFIED CULTIVATION TECHNIQUES

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

ORTOBIOATTIVO, agroecology for the sustainable production of nutraceutical vegetables

Italy

Development and adoption of a new agronomic approach for vegetable cultivation called “Ortobioattivo”. This model focuses on the quality of the substrate/soil and the microbiological biodiversity contained therein as a fundamental element for the cultivation of healthy plants, capable of defending themselves almost autonomously from pathogens and capable of being naturally rich in nutrients of interest for human health (nutraceutical bioactive substances).

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Generally, use of fertilizers or bio fertilizers.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The creation and management of a bioactive garden are easy to implement, and this makes the system replicable and transferable not only in horticultural companies present in the area affected by the cooperation project but also in those present in other regional and extra-regional territorial realities.

How long did it take to implement the practice and which are the measures needed to monitor? It took 32 Months

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Spain, Poland, Greece, Slovenia, Netherlands, France, Latvia, Hungary, Italy, Belgium, Sweden

Project Keywords

Links

STRATUS - Good Practices -Soil Quality - ORTOBIOATTIVO: AGROECOLOGY FOR THE SUSTAINABLE PRODUCTION OF NUTRACEUTICAL VEGETABLES

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

IOCONCIV introduction and optimization of techniques and systems for control of vineyard weed flora

Italy

The general objective is to reduce the use of herbicides in Tuscan vineyards (glyphosate in particular) and improve the fertility of vineyard soils. The proposed innovation involves the use of cover crops under the vine rows in order to reduce the use of herbicides or soil tillage with consequent economic and environmental benefits.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? In the Region, practices are different, it depends on area and knowledge of the farmers.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Weed control in the sub-row, the decrease in soil fertility, the loss of biodiversity, soil erosion and the increase in the use of chemicals represent the weak points of most of the Tuscan winemaking system. The project tested eco-friendly techniques in 4 farms with different soil characteristics and management systems (conventional and organic). Each farm tested 3 soil and weed management systems in the vineyard during a period of 3 years. The management systems tested were: (TA) conventional system based on soil tillage under and between the rows + application of herbicide under the row (for conventional agriculture); (PI) grassing of the sub-row with *Trifolium subterraneum* + inter-row managed conventionally; (TI) grassing of the sub-row with *Trifolium subterraneum* + grassing of the inter-row with a mixture of different species. Grassing significantly improved the carbon balance by increasing carbon sequestration in soil and biomass and reducing emissions.

How long did it take to implement the practice and which are the measures needed to monitor? It Took 44 months

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

Geographical location

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Project Keywords

Links

STRATUS - Good Practices -Soil Quality - IOCONCIV INTRODUCTION AND OPTIMIZATION OF TECHNIQUES AND SYSTEMS FOR CONTROL OF VINEYARD WEED FLORA

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Catch crops

Poland

A plant grown between two main crops for green fodder, hay, silage, ploughing as green manure or leaving in the form of mulch after they have been cut, dumped or destroyed by frost.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Cultivation of white mustard.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Preparation of the ground for sowing seeds, mulching, ploughing.

How long did it take to implement the practice and which are the measures needed to monitor? 1 year

SOURCE PROJECT

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Spain, Poland, Greece, Slovenia, Netherlands, France, Latvia, Hungary, Italy, Belgium, Sweden

Project Keywords

Links

STRATUS - Good Practices -Soil Quality - CATCH CROPS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Soil liming

Poland

Due to sandy soils (70%) and climate, Poland has problems with soil acidification. Over 4 million hectares have a pH in KCl below 5.0 – such soils can be considered degraded – they have a damaged structure, plants are not able to absorb nutrients, which leads to water pollution. An additional problem is the fact that most of the acidic soils are owned by small farms. The practice consists of a wide action of soil pH analysis, establishment of liming programs and reimbursement of part of the costs from CAP funds – eco-schemes fertilization with liming.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Standard soil liming.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? This is the basic solution to improve the efficiency of management and protect the water environment.

How long did it take to implement the practice and which are the measures needed to monitor? A longer period of time, due to the scale of the problem and the target audience – small farmers

SOURCE PROJECT

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Project Keywords

Links

STRATUS - Good Practices - Soil Quality- SOIL LIMING

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Split n application – for grain crops, dividng the dose into 2 or 3 split applications

Spain

This practice is quite common in our region, and it is indeed one of the easiest ways to ensure fertilizer efficiency. Our recommendation is to split N application when the dose is higher than 120 NFU. When using this practice, farmers usually split N fertilizer in two separated applications, close to the moments when the crop has higher needs.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard is to split N application in two separated applications. Some farmers even apply it in three times.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The main point is to reduce N losses to the environment.

SOURCE PROJECT

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Project Keywords

Links

STRATUS - Good Practices - Soil Quality - SPLIT N APPLICATION. FOR GRAIN CROPS, DIVIDING THE DOSE INTO 2 OR 3 SPLIT APPLICATIONS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Optimal organic matter balance

Netherlands

Calculating an organic matter balance provides insights into the inputs and outputs of organic matter within an agricultural system. Organic matter plays an important role in maintaining soil health, contributing to improved water retention, soil aeration, structure, and carbon sequestration. While many farmers recognise the importance of organic matter and understand the need to preserve or enhance its levels in the soil, the quantification of organic matter inputs and outputs is often overlooked. This is especially true over longer periods, where monitoring the organic matter balance over multiple years is rarely done.

By accounting for both the inputs and outputs of organic matter, farmers can get a clear understanding of their farming system's long-term sustainability and the impacts on soil health. Inputs include sources such as crop residues, animal manure, cover crops, and compost. The output of organic matter is its degradation, which is influenced by factors such as microbial degradation, crop growth, soil tillage practices, and external environmental conditions like rainfall and temperature.

Estimating the degradation of organic matter might be challenging. However, there are standardised values that estimate the organic matter degradation rate per crop. Additionally, models that include additional factors like temperature, soil type and moisture can be used to make more precise estimations on the organic matter degradation rate.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Farmers rarely calculate their organic matter balance. Instead, the organic matter input is mostly based on the system (crop rotation/green manure use/crop residue management) that has been applied in the years before and on which external organic matter inputs are easily available/suits the way of working.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? A reduction in soil quality and organic matter content.

How long did it take to implement the practice and which are the measures needed to monitor? Multiple hours per year

AdviSor neTwork foR OptimAl ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Soil Quality - OPTIMAL ORGANIC MATTER
BALANCE

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Manure mediation including digested sewage sludge

Sweden

Manure mediation represents a strategy whereby farms with an abundance of organic manure can sell this resource to other farms that has a deficit of organic carbon in their system. This approach facilitates the transfer of nutrients from an area with a higher potential for nutrient leaching to an area with a demand for both nutrients and organic carbon and thereby enhancing soil quality.

The idea is similar for mediation of digested sewage sludge, whereby this as well is transported to regions exhibiting a deficiency in such materials.

This practice is conducted on a farm scale, with the farmer themselves determining the location of the greatest need for organic manure.

The mediation and trade of the manure may be managed by advisory companies or by the farmers themselves. Through the advisory network, the farmers can receive assistance in testing the nutrient content of the manure and in determining its market value. The farmers contact the advisory company with information about how much and what kind of manure they have for sale. The prize of the manure is based on the nutrient content and distance of shipping distance.

However, the supply of digested sludge is handled by specialised companies due to the regulations, analysis and contracts with the treatment plants. However, this is free of charge for farmers.

The mediation of manure depends on the distance from the seller to the buyer, with the value of the manure decreasing with distance. Distance is not a problem for digested sewage sludge.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard practice for farms with an abundance of organic manure is to utilise it on their own farms. This leads to a risk of nitrogen and phosphorus leakage. Conversely, farms with no own production of organic manure may experience difficulties in providing organic carbon to the soil and has a hard time increase mulch.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? In Sweden, there are regions where dairy and beef production is the primary agricultural activity, and there are also regions where cereal production is the dominant agricultural practice. The presence of cattle in these areas results in a considerable supply of organic manure, which can lead to the leakage of nitrogen and phosphorus. However, these areas also exhibit a favourable supply of organic carbon and present an opportunity to enhance soil quality. Conversely,

farms engaged in cereal production do not experience the same degree of nitrogen and phosphorus leakage. However, they face a more significant challenge in increasing mulch and enhancing soil quality. Given the circumstances surrounding the increase in nitrogen prices, organic manure has become a more prominent source of nitrogen for cereal producers. This is due to a combination of factors, including the desire to increase mulch and improve soil quality.

How long did it take to implement the practice and which are the measures needed to monitor? The strategy has been in place for some time. However, the subsequent rapid increase in nitrogen prices has had a positive effect on the valuation of organic manure.

SOURCE PROJECT

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[STRATUS - Good Practices - Soil Quality - MANURE MEDIATION INCLUDING DIGESTED SEWAGE SLUDGE](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Strip-till in sunflower crop

Spain

Strip-till is a minimum tillage practice. This practice combines the advantages of conventional tillage and the soil-protecting benefits of no-till, as the soil is only disturbed on the seed row.

In our region, direct seeding is a common practice for grain crops, showing similar yield results to conventional tillage systems. In the specific case of sunflower, direct seeding is not a widespread practice, as no-tilled soil seems to be a problem for root development.

Strip-till appears to be a practice that can solve this issues, as sunflower roots are able to explore soil depth while soil structure is preserved.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Ploughing and seedbed preparation.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Direct seeding has not shown good yield results on sunflower crop in the region.

SOURCE PROJECT

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STRATUS - Good Practices - Soin Quality - STRIP-TILL IN SUNFLOWER CROP

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Soil passport or farm soil and waterplan

Netherlands

Based on all the properties of the soil, you'll be able to advise on measurements to decrease the loss of nitrogen and phosphorus to the environment and how to manage water in the best way possible.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Soil information (like type of soil) is available in "bodemdata.nl". In addition, farmers take soil samples, but these are not stored nor accessible in a general database. Water quality is managed by water boards according to the Water Framework Directive.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? To minimise the loss of N and P.

How long did it take to implement the practice and which are the measures needed to monitor? 1 hour to fill in all the questions and half hour to choose the measurements.

SOURCE PROJECT

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STRATUS - Good Practices - Soil Quality - SOIL PASSPORT OR FARM SOIL AND WATERPLAN

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Cut and carry fertiliser

Netherlands

Instead of 'brown' manure. The pathway over animals gives products but is accompanied by substantial losses of nitrogen. Using the grassclover directly, these losses are avoided. Technically seen there is no problem: no new machinery is needed or other challenges to be overcome.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Put grassclover in the cow (goat) and get back the manure.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? In organic farming the use of manure from conventional animal husbandry is (limited) allowed. This is a situation which is considered as unwanted. If this source of (nitrogen) input is rejected, own nitrogen fixation and reduction of N-losses become essential. Loosing nitrogen by putting grassclover in a cow is not wise in that situation.

How long did it take to implement the practice and which are the measures needed to monitor? We needed ten years of on-farm research to 1. document the way this fertilizer functions, and 2. to find out the practical consequences. The overall outcome is simple: the nitrogen deliverance can be well predicted, and the practice is applicable for a lot of farmers.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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STRATUS - Good Practices - Soil Quality - CUT&CARRY FERTILIZER

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

SOILEXACT: THE USE OF SOIL MOISTURE SENSORS TO OPTIMIZE IRRIGATION AND SOIL MOISTURE CONTENT TO IMPROVE MINERAL UPTAKE AND CROP GROWTH

Netherlands

Soil moisture sensors can measure soil moisture content. Growers use that information, for example, to prioritize irrigation of fields: which ones should be irrigated first, which can wait? This is especially important in situations where the fields of a farmer are spread over a wider region. There the transport and start of the irrigation set is a limiting factor in farm management, it might even be impossible to irrigate all fields that need it. Furthermore, optimal irrigation is needed for optimal uptake of minerals by plants. If uptake is not optimized, growth is affected plus minerals stay in the cultivation layer and may leach in case of heavy rainfall or in case of excessive irrigation (double negative effect!).

So, soil moisture has a strong direct and indirect effect on the profitability and sustainability of fertilizer management. A specific challenge for soil sensors is to install them in a way that they are representative for the field in which they are situated. The soil around the sensors should have a good connection, but not too firm; they should not be installed in a border and also not in places where the machines can destroy them. To cope with these challenges, different designs are available; mostly complex and expensive but also swarms of small sensors are under development. In the next years possibilities will expand, giving new impulses for precision agriculture.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The majority of farmers fertilise and irrigate traditionally. When fertilisation takes place in dry periods, shortly after fertilising, irrigation will take place to stimulate mineral absorption.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Farmers don't really know when they need to start irrigation.

How long did it take to implement the practice and which are the measures needed to monitor? Soil moisture sensors are here for a couple of years. But the cost benefits are somewhat

hard to compare. When it is dry farmers just need to irrigate and in those moments soil sensors are not really useful. But when it is starting to get dry you might have an advantage when you use a sensor.

SOURCE PROJECT

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PRACTICE ABSTRACT - RESEARCH AND INNOVATION

ADVANCED NUTRIENT MANAGEMENT USING SOIL ANALYSIS AND GROWTH SIMULATION

Netherlands

To optimise crop growth throughout the season, it is important to offer the right amount of fertiliser to the crop at the right time. In The Netherlands several institutes offer a method that combines soil samples and crop growth modelling to optimize crop yield while minimizing the environmental impact.

The method works by collecting soil samples to assess the current available nutrients. These samples are combined with crop-specific growth models to simulate plant development and nutrient demand. These models account for factors such as planting date and soil type and give advice about the amount of nutrients a farmer should give till the end of the grow season.

This integration enhances decision-making by providing a comprehensive overview of nutrient management practices. For example, a farmer uses a standard fertilizer at the beginning of the growing season, which consists mainly of slurry. During the growing season, an additional soil sample provides the optimal amount of fertilizer. The main benefits of applying this practice are:

- a) By optimizing fertilization this method can help farmers achieve higher yields and better crop quality.
- b) Precise nutrient application minimizes the risk of nitrogen leaching and emissions of greenhouse gases.
- c) By applying only the necessary amount of fertilizer, farmers can reduce input costs.
- d) This practice helps farmers comply with strict nitrate regulations by providing data-driven recommendations.

A real example comes from a potato farmer in a region with sandy soils. This method uses extra soil samples, and crop growth models to determine that 50 kg N/ha is needed at a specific time. By following this recommendation, the farmer can optimize nitrogen use, reduce environmental impact, and maximize wheat yield. By leveraging advanced technology and data-driven insights, this method empowers farmers to make informed decisions about nitrogen fertilization, leading to more sustainable and profitable agriculture.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? In this region, the standard practice for fertilization is a standardized fertilizer plan. This typically involves applying uniform fertilizer rates across entire fields based on general crop requirements and past experiences. While this approach is straightforward and widely used, it often fails to account for variations in soil nutrient levels, weather conditions, and crop growth patterns within a field.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? In the Netherlands nitrate regulations are quite strict so farmers needed ways to have more control to adjust the amount of fertilizer they use during the season.

How long did it take to implement the practice and which are the measures needed to monitor? These extra samples are used in horticulture crops for years, with the rising cost of fertilisers around the world. Arable crop farmers started to use these samples more often.

SOURCE PROJECT

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Project Keywords

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[STRATUS - Good Practices - Precision Farming - ADVANCED NUTRIENT MANAGEMENT USING SOIL ANALYSIS AND GROWTH SIMULATION](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

ZERO SPOTS METHOD TO OPTIMIZE WHEAT NITROGEN FERTILIZATION

Sweden

The zero-spot fertilization method for winter wheat applies nitrogen in three steps:

1. **Early spring (BBCH 30, mid-March):** 25–40% of total estimated N.
2. **Main application (BBCH 30, mid-April):** 40–55%, ensuring availability at shooting (BBCH 32).
3. **Final application (BBCH 39, mid-May):** Rate calculated from zero-spot measurements.

A **zero spot** is a 3×4 m unfertilized area used to quantify the soil's nitrogen supply. Satellite-based biomass data distributes the final supplementary N. After evaluating zero-spot N uptake, the total N requirement is calculated using formulas based on wheat variety and use. Varieties are grouped by optimal protein level:

1. Low protein <10%,
2. Medium 10–12%,
3. High >12%.

Nitrogen need also depends on final use:

- A) Own feed/bread wheat: 22 kg N/t harvest,
- B) Industrial feed or starch wheat (medium/high protein): 20 kg N/t,
- C) Industrial feed or starch wheat (low protein): 15 kg N/t.

Zero spots are established in spring and kept nitrogen-free through all fertilizations. Near BBCH 39, nitrogen uptake in the zero spots is measured using Yara N-tester and image analysis in Yara Atfarm. These values, along with variety, use, expected yield, and previous fertilization, are entered into Yara's formula to determine the supplementary N requirement. This value is then used to create an optimal variable-rate distribution via Atfarm or Cropsat.

In these tools, the zero-spot reading is calibrated to satellite images to assign it correctly within the field. A VRA (Variable Rate Application) file is then generated for the final N application.

If two zero spots are used during organic fertilizer spreading—one receiving only organic fertilizer and one receiving no N—the contribution of the organic fertilizer can also be calculated by comparing N uptake in both spots.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region?

Most farmers use **three nitrogen applications**, similar to the zero-spot method. However, N levels are determined from **experience**, previous years' results, and the fertilization done during the previous winter, rather than from in-season measurements.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice?

Traditional N field experiments only provided the optimal fertilization strategy **after harvest**, and no tools existed to assess N needs **during** the season or adjust applications according to crop and field variation. Analyses of N trials showed that differences in N requirements at sites with the same yield were driven by **soil nitrogen delivery**, measurable through **nitrogen zero spots**. At the same time, new variety-specific experiments showed that Swedish winter wheat can be divided into **three groups** based on kernel protein at optimal N. These results enabled calculation tools combining **variety characteristics**, **final wheat use**, **expected yield**, and **soil N supply**. Later, the method was linked to **satellite-based biomass maps** to enable variable-rate fertilization instead of uniform dosing, applying N according to real crop needs.

How long did it take to implement the practice and which are the measures needed to monitor?

The zero-spot method is based on knowledge built up over **several years**. It took about **10 years** from the start of N-evaluation trials to a practical farmer-ready method. Once developed, uptake was quick. In **2015**, farmers used a handheld N sensor, but this was slow because one device had to be shared across farms. From 2015 onward, other indirect measurements (e.g., straw-length image analysis) were tested to simplify N uptake assessment. In **2024**, farmers could finally measure N uptake in their own zero spots without

SOURCE PROJECT

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STRATUS - Good Practices - Precision Farming - ZERO SPOTS METHOD TO
OPTIMIZE WHEAT NITROGEN FERTILIZATION

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

USE OF MOBILE APPS AND SATELLITE IMAGES TO IDENTIFY FERTILISATION NEEDS

Slovenia

This practice describes the use of available satellite images to monitor actual crop status and act quickly on it. This helps to use fertiliser inputs more efficiently and reduce costs. Variable rate fertiliser prescription maps are traditionally based on soil samples of a given area. The aim of this new approach is to optimize fertiliser use, reduce costs and at the same time increase the efficiency of fertilization using crop information acquired from satellite images. Satellite images make it possible to retrieve information on the state of agricultural areas in a global level. These images can be used so that farmers, researchers and agronomists can monitor plant growth, assess field conditions and identify potential problems that affect the quantity and quality of crops. With the latest development of satellite technology, images have become increasingly accurate and more accessible, making it easier to use them in agricultural practice. A significant advantage is the speed with which information on the situation of crops in the field can be obtained so that the farmer can react immediately with the application of appropriate fertilisers at the right location.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Standard practice is to calculate fertilizer application rate based on soil and plant analyses, use a fertiliser plan and apply the same amount over and over again, regardless of soil and plant variability.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Cost of investment in technology, especially on smaller farms

How long did it take to implement the practice and which are the measures needed to monitor? 3 - 5 years

SOURCE PROJECT

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STRATUS - Good Practices - Precision Farming - USE OF MOBILE APPS AND SATELLITE IMAGES TO IDENTIFY FERTILISATION NEEDS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

DEVELOPING PRECISE FERTILISATION PLANS WITH REGARD TO VRA USING SATELLITE IMAGERY AND DRONES IN MAIZE AND CEREALS

Slovenia

Satellite images are well suited for crops like cereals, maize, and other field crops because their scale matches the spatial resolution of **Sentinel-2**. Combined with drone data, they support **Variable Rate Application (VRA)** of fertilizers. Optical satellites and multispectral drones capture high-resolution imagery and vegetation indices such as **NDVI** and **NDRE**, revealing field zones with differences in crop health, growth, or nutrient status. These zones often need targeted checks such as **nitrate tests** or **soil sampling**.

To support fieldwork, farmers use a mobile app developed in the **EIP Precision Farming and Digitalisation** project. The app displays maps guiding users to zones flagged by satellite data. Farmers can navigate to underperforming areas, enter soil nitrate results, and add real-time observations. This combination of remote sensing and ground-truth data increases accuracy and reliability.

Agronomists analyze all collected data to produce **targeted fertilization recommendations** and a digital fertilization plan. Farmers transfer these files to machinery via **USB**, cloud systems, or wireless connections.

Integrating satellite images, drone data, soil measurements, and precision equipment improves fertilizer accuracy. When combined with soil analysis, farmers gain a complete view of plant and soil needs. Satellite imagery highlights variability, while soil data confirms nutrient deficiencies, enabling highly precise fertilizer adjustments.

Using **VRA** provides higher yields, lower fertilizer costs, and reduced environmental impact. Precision dosing avoids over-fertilizing healthy zones and supplies extra nutrients to weaker areas, creating more uniform growth and better resource efficiency. This supports sustainable farming by reducing nutrient leaching, protecting water quality, and lowering greenhouse gas emissions.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region?

Most farmers use **conventional fertilisation with one uniform dose** across the whole area. The rate is set “by feel,” based on recommended and allowed annual N levels. This often leads to **over- or under-fertilisation**, inefficient nutrient use, environmental impacts, and yield variability. Only a few farmers create an N plan using soil or plant samples, and even then, the plan specifies **one single rate** per fertiliser and growth stage for the entire field.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice?

The main challenge was the **underuse of modern VRA-capable machinery**. Many farms own equipment that can perform VRA but still apply **uniform fertiliser rates**, using only section control. Because VRA requires advanced knowledge and digital skills, farms often rely on specialists or highly trained technologists. For larger farms, VRA offers opportunities to **save money, increase profitability, and protect natural resources**. Smaller farms face different drivers, such as **crop levelling**, reducing fertiliser use (especially during price spikes), and gaining knowledge through the project to learn how to apply VRA effectively.

How long did it take to implement the practice and which are the measures needed to monitor?

Introducing the method typically takes **one growing season**, depending on farmer initiative and technical ability. Adoption requires significant learning and practice. Monitoring includes **checking satellite images**, tracking fertiliser use, and evaluating field performance.

SOURCE PROJECT

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PRACTICE ABSTRACT - RESEARCH AND INNOVATION

FERTILISER SPREAD PATTERN MEASUREMENT AND SPREADER ADJUSTMENT USING COLLECTION TRAYS

Belgium

Optimizing fertilizer inputs is crucial to reduce agriculture's environmental impact while meeting global demand for food, fibre, and fuel. **Centrifugal fertilizer spreaders** are the most common mineral fertilizer machines due to their wide working width, small size, low cost, and simple, robust design. Despite this simplicity, the spreading process is hard to control because it depends on particle properties, wind, and machine settings. This often causes deviations between desired and actual spread patterns, leading to **under- and over-application** and losses beyond the field.

To evaluate spreader performance and adjust settings, farmers must determine the **spread pattern**. Uniformity is assessed by measuring the **single transverse spread pattern** using a row of collection trays placed perpendicular to the driving direction. Material collected in each tray is weighed and converted into an application rate. Broadcast spreaders typically create **gauss- or trapezoid-shaped** patterns, with higher doses centrally behind the spreader and decreasing rates toward the edges. This requires **overlap between swaths** for homogeneous distribution.

Uniformity across the swath width is expressed as the **coefficient of variation (CV)**. Optimal swath width and application rate are determined from the measured pattern. The **European standard EN13739 (2003)** requires that the CV must not exceed **15%**. If an undesirable pattern is found, the spreader should be adjusted—e.g., vane position, spreader height, orifice position. This method is mainly used for mineral fertilizer centrifugal spreaders but also applies to **pendulum and manure spreaders**.

Because of their wide working width and pattern shape, broadcast spreaders also risk **spreading beyond field borders**. To avoid environmental losses, various **border spreading technologies** (e.g., deflector plates, disc-integrated systems) are available.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? In most cases no check of the spread pattern is performed. Adjustment of the spreader is done following the instructions of the machine manufacturer or a default setting is used.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Poor distribution of the fertilizer leads to yield losses, visible spreading lanes and quality difference within the field. Fertilizer losses out of the field mean economic losses for the farmer, losses to the environment and are bad for the reputation of the farmer.

How long did it take to implement the practice and which are the measures needed to monitor? ILVO's fertilizer spreader calibration service was established as the result of a 4-year research project and is operational for several years. Due to the large spreading widths, performing spread pattern tests is a very laborious, time-consuming process. Adjusting the spreader needs some operational knowledge combined with trial and error which makes spread pattern measurements quite expensive. In addition, measurements are weather dependent and require a lot of space. Finally, there is no mandatory spreader testing in Europe which is different from sprayers. For these reasons, and despite the clear advantages, the level of implementation by farmers is relatively low. The level of implementation could increase by setting up a (voluntary or mandatory) spreader testing campaign and/or to foresee some subsidies for farmers testing their spreader. Today, there is no direct monitoring. Indirect monitoring is done among others by measuring nitrogen content in soil and surface water.

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[STRATUS - Good Practices - Precision Farming - FERTILISER SPREAD PATTERN MEASUREMENT AND SPREADER ADJUSTMENT USING COLLECTION TRAYS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

USE OF THE ONLINE INFORMATION PLATFORM WATCHITGROW TO GENERATE TASK MAPS FOR VARIABLE FERTILISER APPLICATIONS

Belgium

WatchITgrow is an online platform helping farmers monitor arable crops and vegetables to improve yield quality and quantity. It serves growers, contractors, advisors, and buyers. It combines satellite, weather, soil, IoT, and farmer field data. Using big data analytics and machine learning, it provides timely, personalized advice. Farmers can store field info such as variety; planting/harvest dates; and fertilizer, pesticide, or irrigation applications, and choose whether to share it.

The platform shows crop growth from satellite images. Greenness maps reveal within-field variability and allow field-to-field comparisons. Weather data (temperature, rainfall) help assess risks for production or quality losses. WatchITgrow also provides yield forecasts for **Bintje** and **Fontane** potatoes and can create application maps for **variable rate planting, irrigation, haulm killing, and variable fertilization**.

To create a variable fertilization map, the farmer selects the machine, fertilizer type (mineral, organic, compost), and product(s). They may choose an existing product or create one by adding minerals, then enter the normal dose (kg/ha or l/ha). With "Auto dosage," this dose is distributed across zones based on the chosen strategy: **"Make bad areas better"** increases doses in low-greenness zones; **"Make good areas better"** increases doses in high-greenness zones. Manual adjustments remain possible.

Zones are defined using **fAPAR** greenness images from Sentinel-2. fAPAR measures the fraction of solar radiation absorbed by green, living leaves. Each pixel is compared with the field's median greenness and grouped into five classes: **<85%, 85–95%, 95–105%, 105–115%, >115%**. Finally, the farmer names the map, may add an advice date, and downloads a shapefile containing polygons and fertilizer doses for use in variable rate fertilization equipment.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? A uniform quantity of fertilizer is applied to the field, usually based on a soil sample analysis and advice at parcel level. Variation in soil quality/fertilizer need within the parcel is not taken into account.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? In most agricultural fields, a natural variation in soil quality is observed, which is linked to the yield potential. If the farmer applies a uniform dose of fertilizer on the field, zones with an overdose or underdosage will occur. This leads to a low efficiency in fertilizer use. The evolution towards precision agriculture allows this variation to be mapped and managed accordingly. WatchITgrow provides information on crop growth and development as observed from satellite images. From the greenness maps you can easily detect variability within your field and create application maps for variable rate.

How long did it take to implement the practice and which are the measures needed to monitor? The first version of the WatchITgrow platform was developed within the iPot research project in the period 2014-2016 and was launched in 2016 focusing the field and yield data in potato production. Since then and till today, the tool was continuously improved and expanded with additional crops and modules including variable fertilization. To promote the use of the platform, Belgian potato farmers could receive a financial bonus from their buyer in 2019 and 2020 when they actively use the WatchITgrow platform to submit field data and actual yields. The platform can be used to monitor fields in Belgium and surrounding countries.

SOURCE PROJECT

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Links

[STRATUS - Good Practices - Precision Farming - USE OF THE ONLINE INFORMATION PLATFORM WATCHITGROW TO GENERATE TASK MAPS FOR VARIABLE FERTILISER APPLICATIONS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

CROPSAT - FREE SATELLITE IMAGERY FOR TAILORED NITROGEN FERTILIZATION IN WHEAT

Sweden

CropSat is a free Swedish precision farming tool that uses satellite imagery to optimize nitrogen fertilization for crops such as wheat and other cereals. It relies on **NDVI data** from satellites captured every **2–5 days** to monitor crop growth, biomass, and field variability. Using these insights, CropSat generates nitrogen application maps that improve efficiency, reduce costs, and lower environmental impact.

Farmers access CropSat through its user-friendly web platform, where fields appear on an interactive map showing vegetation differences caused by soil quality, water availability, or nutrient issues. These variations help identify underperforming zones needing targeted fertilization.

To create **Variable Rate Application (VRA)** maps, the user follows several steps:

- a) Satellite imagery detects crop health and biomass variability as the basis for precision planning.
- b) Farmers generate maps by choosing the field, crop, and target nitrogen rates, and entering parameters such as fertilizer product type.
- c) The VRA map can be downloaded as **ISO-XML** or **Shapefile**, ensuring compatibility with modern tractor guidance systems and variable rate spreaders.
- d) The task map is uploaded to the tractor terminal, enabling automatic adjustment of nitrogen rates in real time. This prevents over-fertilization in healthy zones and adds nutrients where needed.

CropSat boosts yields, sustainability, and fertilizer savings by replacing uniform nitrogen application with maps that account for field variability. It solves past inefficiencies where some zones were over-fertilized—causing higher costs and nitrogen leaching—while others were under-fertilized, reducing yields.

Compared with tools like N-sensors, CropSat is more affordable and accessible, requiring no expensive equipment and only basic digital skills. Farmers simply need internet access, a compatible variable rate

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? If farmers do not use VRA for their nitrogen application, they use recommended nitrogen rate tables, which correlate with the crop and the expected yield. The same amount of nitrogen is then applied to the whole field without taking into account field variations.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Nitrogen fertiliser is a major expense for farmers and has a negative impact on the environment. A more resource-efficient approach to nitrogen application has both economic and environmental benefits. Previously, nitrogen fertilizer was applied evenly across fields, which led to inefficiencies: some areas received excessive amounts, while others received too little. Alternatively, farmers had to invest in expensive N-sensors. Compared to using satellite imagery, spreading nitrogen more evenly over the field reduces fertiliser costs, gives better and more consistent crop quality and reduces nitrogen emissions.

How long did it take to implement the practice and which are the measures needed to monitor? The system was developed in 2014-2015 in a collaboration of... There was an earlier version of Cropsat but it was not as user-friendly and accurate. After the development of 2014-2015 Cropsat is integrated and developed by DataVäxt. The use of Cropsat has been gradual since 2015, but by 2024 it is an established part of grain production for cereal farmers.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

ONGOING | 2024-2029

Main funding source

Horizon Europe (EU Research and Innovation Programme)

Geographical location

Spain, Poland, Greece, Slovenia, Netherlands, France, Latvia, Hungary, Italy, Belgium, Sweden

Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - CROPSAT - FREE SATELLITE IMAGERY FOR TAILORED NITROGEN FERTILIZATION IN WHEAT](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

SITE SPECIFIC ESTIMATION OF WINTER CEREALS AND RAPESEED NITROGEN NEEDS VIA SATELLITE IMAGERY (MES SAT'IMAGES, FARMSTAR)

France

The theoretical calculation of crop nitrogen needs in France has been carried out since 1992. This calculation is used to comply with the Nitrates Directive (European directive). The necessary data are provided by technical institutes and aggregated through COMIFER (French Committee for the Study and Development of Rational Fertilization). Estimating crop needs using satellite imagery is a major advance in precision agriculture. The images captured reveal information on plant cover (biomass) and allow the modelling of plant nitrogen content (Nitrogen Nutrition Index) to assess plant nitrogen needs and advise farmers on their site-specific fertilization practices for winter cereals and rapeseed.

Thanks to spectral indices such as the Normalized Difference Vegetation Index (NDVI), farmers can identify areas requiring specific nitrogen inputs. All farmers can use these digital solutions (such as Mes Sat'images and Farmstar) to optimize their fertilization strategy both with solid and liquid fertilisers. Fertilisers can be applied uniformly all over the field using conventional equipment or at different rates in each part of the field using precision farming tools using e.g. the ISOBUS standardized data exchange format (ISOXML). ISOXML facilitates the interoperability between the precision farming tools and software packages such as Farmstar. This optimizes fertilization, thereby reducing costs and minimizing environmental impact. In addition, this approach promotes sustainable resource management, while increasing yields. By integrating satellite imagery into agricultural practices, it becomes possible to respond more precisely to the crop needs, ensuring a more efficient and resilient food production.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Standard practice is to apply the nitrogen balance method (COMIFER Guide to Reasoned Fertilization). Over a given period of time, the mass balance of the soil mineral nitrogen stock in the crop root zone is written as follows: Final state - Initial state = Inputs – Outputs

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Agronomic and economic optimization of nitrogen management (reasoning the inputs to provide the right dose)

How long did it take to implement the practice and which are the measures needed to monitor? Since 1992, the use of COMIFER gradually increase up to about 1/3 of the winter cereals and rapeseed area in France in 2024 (7 500 000 hectares total)

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Precision Farming - SITE SPECIFIC ESTIMATION OF WINTER CEREALS AND RAPESEED NITROGEN NEEDS VIA SATELLITE IMAGERY (MES SAT'IMAGES, FARMSTAR).

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

PRESCRIPTION MAPS FOR VARIABLE RATE FERTILISATION USING CROP VIGOR MAPS

Italy

Site-specific fertilization using **vigor maps** is a precision farming method that optimizes fertilizer use, improves yields, and reduces nutrient losses and environmental impacts. Vigor maps are generated from data collected by sensors on machinery, drones, or satellites. These sensors capture plant health indicators such as **NDVI**, which measures reflection in the near-infrared spectrum and is strongly linked to plant vigor and photosynthesis. **Multispectral cameras** provide the highest accuracy.

For **tree crops**, drone-mounted sensors are most effective because satellite resolution is too low for precise fertilization recommendations. For **field crops** like cereals or maize, satellite imagery is a cost-effective option with sufficient spatial resolution. Field sensors are useful for specific purposes—e.g., disease forecasting or water-stress monitoring—but their point-in-time measurements may not represent the entire field. By combining vigor maps with field data and soil analysis, farmers obtain a complete picture of crop health and nutrient needs.

This technique supports the creation of **prescription maps** for **Variable Rate Fertilization (VRF)**. These maps guide equipment to apply fertilizers at the correct rate and location, addressing nutrient deficiencies while avoiding over-application in areas already sufficient. Integrating vigor maps with VRF improves productivity and supports sustainability by reducing risks such as nutrient runoff and soil degradation. Farmers and agronomists benefit from more efficient input use, better crop quality, and improved compliance with environmental regulations, making vigor maps a valuable tool in modern precision agriculture.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard practice in this region involves fertilization with a single, uniform dose applied across the entire field for each crop type. This approach is based on generalized recommendations rather than site-specific data, often leading to inefficiencies. While straightforward and easy to implement, this method does not account for variability in soil fertility, crop nutrient requirements, or field conditions. As a result, it can lead to over-fertilization in some areas, increasing nutrient leaching and environmental risks, and under-fertilization in others, potentially limiting crop yields. In contrast, precision fertilization practices, such as those using vigor maps, offer a more targeted approach that addresses these limitations.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Lower costs due to reduction in the quantity of fertilizer used, lower environmental impact

How long did it take to implement the practice and which are the measures needed to monitor? Depends on the progress of the growing season and ranges from three to six months

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - PRESCRIPTION MAPS FOR VARIABLE RATE FERTILISATION USING CROP VIGOR MAPS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

PRESCRIPTION MAPS FOR FERTILIZATIONS IN VINEYARDS USING 3D POINT CLOUD AND AI ALGORITHMS ON A MOBILE DEVICE

Italy

The **iAgro Mobile App** uses 3D point clouds (big data) to optimize **variable-rate fertilization in vineyards**. Acting as a **Decision Support System (DSS)**, it applies AI-based computer vision to analyze a vineyard's digital twin and assess canopy biometrics and field parameters. From this analysis, the app generates **vigor maps** and **prescription maps** for optimized fertilization.

Designed for **Android/iOS**, the app allows technicians or winegrowers to quickly and objectively assess spatial-temporal variability of vineyard foliage using the smartphone's camera and GPS. Users capture geo-referenced images of the canopy side wall, which are processed through proprietary cloud-based AI. The system automatically determines canopy biometric parameters such as **thickness, height, volume, LAI**, and general vineyard parameters like **LWA** and **TRV**. By manually entering vineyard characteristics (inter-row spacing, phenological phase, disease risk), the user receives the recommended **water dose** for applying fertilizers, along with the **optimized fertilizer dose**.

The app is available on **Apple Store and Google Play** and works on common smartphones. A data connection is not required during field image capture; photos can be uploaded later.

Farmers can scan a row section or an isolated plant. After upload, processing takes a few minutes, after which a **3D point-cloud model** of the scanned area appears on the smartphone. The app provides canopy thickness, height, volume, LAI, LWA, TRV, and the optimal water dose for treatments. By repeating scans at a sufficient number of points (**minimum 5 per field**), the app produces **vigor (LAI) maps** and **optimal water-dose maps** for fertilization or treatments.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Foliar fertilizations at fixed doses and at periodic intervals.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Lower costs due to reduction in the quantity of fertilizers used, lower environmental

impact .

How long did it take to implement the practice and which are the measures needed to monitor? It's an innovative tool, at least two years are needed for the diffusion of the innovative practice.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

ONGOING | 2024-2029

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - PRESCRIPTION MAPS FOR FERTILIZATIONS IN VINEYARDS USING 3D POINT CLOUD AND AI ALGORITHMS ON A MOBILE DEVICE](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

REALTIME MEASURING NITROGEN CONTENT WHEN APPLYING ANIMAL MANURE TO VISUALIZE UNEVEN DISTRIBUTION

Netherlands

When using animal manure, there is often a large variation in the amount of nutrients applied over the field. Manure is transported with trucks and when applying animal manure different trucks come from different locations. Although the manure comes from the same type of animals, the nutrient content of the manure varies depending on the feed the animals ate and the intensity of the mixing of the manure. Farmers get the result of the samples after the manure is applied on the field.

With NIR measurements, the nutrient content of the manure is measured while it is being applied, allowing precision farming as it becomes possible to apply manure based on its content.

With NIR measurements, the nutrient content of the manure is measured in real time while it is being applied. During application, the NIR sensor emits near-infrared light onto the manure as it flows through the applicator. This light interacts with the manure, and the sensor measures the amount of light that is absorbed and reflected at specific wavelengths. Nitrogen has unique absorption patterns, which the sensor analyzes to determine the precise nitrogen content. The data is then processed and displayed in real time, allowing the farmer to adjust application rates immediately.

This way, surpluses can be avoided which potentially result to leaching of nutrients, soil acidification and a poor crop development. On the contrary, areas that receive less nutrients will have a reduced crop yield, lower organic matter input and overall does not reach the full soil potential. If this can be linked to task maps, the variation in the field can be reduced as the application can be adjusted based on the current situation in the field. This way, farmers will reduce costs, minimize emissions and nutrient leaching, while increasing the crop yields. Eventually, this will result in a more sustainable farming practice.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Depends on the crop. This can often be a basic fertilization with slurry with an additional artificial fertilizer.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Uncertainty in the nutrient application with animal manure. Because the inconsistency in animal manure contents, farmers do not know how much nutrients they apply, leading to over/under

application. This leads to both environmental emissions and economical losses, as the yield potential is not achieved.

How long did it take to implement the practice and which are the measures needed to monitor? Once the NIR measurement is developed and installed, similar time as regular animal manure. As there is very little experience with implementing the system, it is not possible to estimate the amount of time it takes to install the tools.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - REALTIME MEASURING NITROGEN CONTENT WHEN APPLYING ANIMAL MANURE TO VISUALIZE UNEVEN DISTRIBUTION](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

SITE SPECIFIC YIELD DETERMINATION IN POTATOES TO UNDERSTAND LOCAL NUTRIENT NEEDS AND SURPLUSES IN CROP RESIDUES

Netherlands

When reviewing the yield quantity for their potato crop, farmers usually calculate the average amount of yield per hectare of a certain field, in some cases even over multiple fields. However, the variation in crop yield within fields can be relatively large. Knowing on what spots in the field crop yields are relatively low can give insights in the optimal fertilization strategy for the upcoming year. When considering the availability of nutrients out of crop residue degradation in the following year, a lower crop yield in this year will indicate less nutrients being available in the crop residues. But a lower crop yield might also indicate a structural lower nutrient content in the soil, indicating the need for more a specific soil analysis on that location. So, insight in the crop yield over a field is the first piece of a puzzle to create the fertilization strategy of the following year. Besides, it can give insight in the profitability of less productive parts of a field. If crop yields are substantially lower in a certain part of a field, crops with high input costs might not be profitable in this site. Quantifying this data might even result in growing different crops in certain locations as the high input crop (for instance potatoes) is not profitable.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Averaging the crop yield per hectare and not linking it to the fertilization strategy of the next year and crop.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The variation in crop yield at different locations in the field can be substantial. Some parts of a field can be more fertile, have a different soil type, might be covered in shade because of trees next to a field, etc. However, the inconsistencies are hardly considered when managing and fertilizing agricultural fields. By monitoring crop yield variation within a field, farmers can gain insight in the variation of a field and take this into account the following year.

How long did it take to implement the practice and which are the measures needed to monitor? Installing the system requires time. As it is technologically advanced soft- and hardware, users need time to install this and learn how to manage this. Depending on the user, this can vary from a couple of hours to multiple working days.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

STRATUS - Good Practices - Precision Farming - SITE SPECIFIC YIELD DETERMINATION IN POTATOES TO UNDERSTAND LOCAL NUTRIENT NEEDS AND SURPLUSES IN CROP RESIDUES

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

PRECISE FERTILIZER APPLICATIONS USING SOFTWARE TOOLS AND SATELLITE NDVI IMAGERY IN ARABLE CROPS

Poland

Polish arable farmers widely use computer programs that calculate the nutrient balance (N, P, K) on the field, and prepare fertilization plans in accordance with the principles of sustainable mineral management. Examples of fertiliser advisory applications software are Macrobil, NawSald, etc. Such tools include mineral, natural and organic fertilisers and support farmers with their proper fertilizer management and making a decision on carbon farming and eco-schemes.

One step further is the use of satellite data to follow up their crops. SatAgro is an online platform designed for farms specialised in arable crop production which is also available in a mobile version (Android). Farmers using SatAgro can monitor their crops, implement precision farming techniques (for fertilisation, sowing and plant protection), keep records, collect and analyse a variety of spatial field data (yield maps, results of electromagnetic soil scanning, meteorological data, etc). The main source of information provided is the normalized difference vegetation index NDVI which is calculated on the basis of satellite images (observations from NASA, ESA and private operators) and quantifies the crop health and density. With its help, farmers receive information about the condition of the crops, as well as their differentiation in space and time what allows to adapt the dosage of fertilizers and plant protection products to the needs of individual field zones

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? Uniform fertilization based on soil sample analyses

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Optimisation of fertiliser use, increase of yields, preservation of the environment

How long did it take to implement the practice and which are the measures needed to monitor? about 1 year

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

STRATUS - Good Practices - Precision Farming - PRECISE FERTILIZER APPLICATIONS USING SOFTWARE TOOLS AND SATELLITE NDVI IMAGERY IN ARABLE CROPS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Variable rate fertilizer application based on NDVI maps created with Sativum app in grain crops

Spain

SATIVUM is the free digital tool chosen by the Spanish Government as the reference farmer's digital book. It was designated as the reference tool in 2024, and it is being developed to have a wide range of functionalities. It allows farmers to register their plots, machinery, agricultural practices, create fertilization plans and follow crop development via satellite imagery. Although the tool it is only focusing on grain crops but also horticultural crops or fruit trees, aspects related to fertilization are most applicable for grain crops.

SATIVUM allows farmers to create fertilization plans based on different parameters such as crop needs, previous crops, potential yield, soil analysis, type of fertilizer, etc. Based on this information, SATIVUM makes a fertilization plan and suggestions on how to make fertilizer applications.

If farmers have variable rate technology, SATIVUM has the option of creating a variable rate map based on satellite imagery. SATIVUM analyses these satellite images and creates NDVI maps that can be used to generate task maps for variable rate fertilizer application (VRFA). SATIVUM allows to create up to 7 different fertilization zones. Farmers only need to decide what is the most suitable dose to be applied in each zone.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard in Spain is to spread N fertilizer with a uniform dose on the entire plot

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The challenge is to manage nutrients in a more efficient and sustainable way, and to reduce water and soil contamination. In addition, some farmers have equipment allowing variable rate applications but not using it. This tool helps to create variable rate application maps.

How long did it take to implement the practice and which are the measures needed to monitor? By the moment there are very few farmers doing this. Many of them have the necessary tools to do it, but it is easier to work the conventional way.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Spain, Poland, Greece, Slovenia, Netherlands, France, Latvia, Hungary, Italy, Belgium, Sweden

Project Keywords

Links

STRATUS - Good Practices - Precision Farming - VARIABLE RATE
FERTILIZER APPLICATION BASED ON NDVI MAPS CREATED WITH
SATIVUM APP IN GRAIN CROPS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

NDVI-driven drone-based field analysis for precision nutrient management

Greece

Drones equipped with multispectral cameras can support precision nutrient and water management by capturing high-resolution images of agricultural fields. Software such as Pix4Dmapper, QGIS or ArcMap processes these images into detailed maps that identify variations in crop health and areas requiring different levels of fertilizers, water or other treatments. Vegetation indices such as NDVI and EVI help detect crop stress and assess plant health, with EVI providing additional value in dense vegetation or where soil background affects results.

This technology is particularly relevant for crops with variable nutrient needs, such as olives, grapes, citrus and vegetables, especially in areas with diverse soils and microclimates. Combined with soil sensors, weather stations, Farm Management Software, GPS/RTK and Variable Rate Technology, drone-based monitoring can improve decision-making and enable precise input application.

Regular flights throughout the growing season also allow farmers to monitor crop responses and adapt fertilization or irrigation accordingly, reducing waste, improving resource efficiency, supporting more sustainable farming and potentially increasing productivity and crop quality. However, effective implementation depends on suitable weather conditions for drone flights and requires basic geoinformatics skills to accurately interpret aerial data.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region?

Traditional fertilization in Greek horticulture and orchards is based on scheduled applications according to estimated crop needs. Increasingly, however, precision agriculture technologies, particularly sensors and drones, are being adopted to improve nutrient use efficiency, reduce over- or under-application, and enhance crop productivity and sustainability.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice?

NDVI-driven drone analysis was introduced to address difficulties in monitoring crop health and field variability in real time. It enables targeted fertiliser and water applications, reducing nutrient losses, soil and water contamination, and unnecessary input use. The practice also improves yield and quality, supports compliance with environmental requirements, responds to market demand for sustainable production, and helps farmers optimize costs and resources.

How long did it take to implement the practice and which are the measures needed to monitor?

Implementation typically takes a few months to one growing season, including planning and equipment procurement (1–2 months), system testing and calibration (around one month), and integration with farm management systems and initial data collection (1–2 months). Monitoring includes regular NDVI analysis, comparison with historical data, yield assessments, and tracking fertilizer and water savings. Environmental impacts, including nutrient runoff, are also assessed. Real-time feedback allows adjustments throughout the season, while periodic economic and environmental evaluations measure cost savings, productivity improvements and overall resource efficiency.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - NDVI-DRIVEN DRONE-BASED FIELD ANALYSIS FOR PRECISION NUTRIENT MANAGEMENT](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Leveraging drone technology for fertilizer optimization in tomato and corn crops

Poland

Fertilizer management using drones is an advanced precision agriculture technique that optimizes nutrient application, improves yields, and reduces environmental impact. It combines drones with multispectral cameras, data analysis software, and precision machinery to apply fertilizers efficiently. For example, a tomato farmer in Poland uses a DJI Mavic 3M drone with a multispectral camera to monitor crop health and generate Variable Rate Application (VRA) maps. The drone captures images in multiple light spectrums, including near-infrared (NIR), to calculate the Normalized Difference Vegetation Index (NDVI), revealing variations in plant vigor and nutrient needs.

The process starts with the drone flying over the field and capturing multispectral images. Software such as DJI Terra or DJI SmartFarm processes these into NDVI maps that highlight areas with different nutrient requirements. This data is then imported into platforms like Pix4Dfields or QGIS to create VRA maps that divide the field into management zones. Additional inputs, such as soil analysis, can further refine recommendations. The maps are exported in formats compatible with fertilizer spreaders like Amazone Amatron, Kuhn CCI Terminal, or John Deere Operations Center, and transferred via USB or SD card. The machinery then adjusts fertilizer rates automatically during application.

After fertilization, the drone performs a follow-up flight to assess crop response and validate the strategy. Comparing pre- and post-application data allows farmers to evaluate effectiveness. In this case, fertilizer use was reduced by 30% while maintaining high yields. Targeted application minimized nutrient runoff, improved soil and water quality, and increased crop uniformity, producing higher-quality tomatoes for premium markets. Environmental benefits also include reduced soil compaction, lower greenhouse gas emissions, and full coverage of hard-to-reach areas.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard practice in this region involves collecting soil samples and conducting laboratory analyses to determine the nutrient content and fertility of the soil. This method provides farmers with general recommendations for fertilization based on the average nutrient needs of the crop and soil conditions across the entire field. While effective for understanding baseline soil fertility, this approach does not account for spatial variability within fields, which can lead to inefficiencies such as over-fertilization in some areas and under-fertilization in others.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The adoption of this practice addresses key inefficiencies in traditional fertilizer application, such as uniform dosing that leads to resource waste, reduced yields, and environmental harm. By leveraging data-driven tools like drones and GPS-enabled machinery, it ensures site-specific

application, optimizing nutrient use and saving time for younger, tech-savvy farmers. Regulatory pressures, including compliance with eco- scheme fertilizer dose limits, and economic drivers like rising input costs further motivate adoption. This practice reduces nutrient leaching, minimizes greenhouse gas emissions, and supports sustainable and profitable farming.

How long did it take to implement the practice and which are the measures needed to monitor? The implementation of the practice typically takes around one year, which includes time for acquiring the necessary equipment, training farmers on using digital tools and machinery, and collecting baseline data such as soil and yield maps. Monitoring measures involve regular drone flights, analysis of NDVI and other vegetation indices, and periodic soil sampling to assess the effectiveness of fertilizer application and make adjustments as needed.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - LEVERAGING DRONE TECHNOLOGY FOR FERTILIZER OPTIMIZATION IN TOMATO AND CORN CROPS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Precision nitrogen management using historical yield maps and variable rate technology in grain crops

Spain

Variable Rate Fertilizer Application (VRFA) based on historical yield maps enables farmers to optimize fertilizer use by targeting specific field zones. It relies on precision harvesters equipped with yield monitors and GPS, which record productivity data during harvest and link it to exact locations, producing detailed yield maps.

The process starts by collecting historical yield data. Farmers upload this information to GIS platforms such as QGIS or ArcGIS, or use commercial tools that automatically generate maps. The data is then analyzed to create VRFA maps that divide the field into zones according to productivity. High-yield areas may require less nitrogen, while lower-performing zones may need more to improve growth.

However, yield maps alone do not account for soil or climate factors that strongly influence productivity. To avoid misinterpretation, farmers should complement them with soil tests or climate data. For instance, low yields may result from poor soil fertility, waterlogging, drought, or pests rather than nutrient deficiency. Integrating these additional datasets improves the accuracy of recommendations. Farmers can also adjust VRFA maps based on field knowledge, correcting zones affected by temporary issues such as extreme weather or pest outbreaks to prevent overapplication.

Once finalized, the VRFA map is exported in a format compatible with variable-rate spreaders or precision equipment. Uploaded to the machine's onboard system, it enables real-time adjustment of fertilizer rates during application, ensuring precise nutrient delivery.

Although VRFA may not reduce total fertilizer use, it improves distribution efficiency, limiting runoff and leaching. This enhances environmental performance, supports regulatory compliance, and can improve yields. When combined with soil and climate data, VRFA becomes a more robust tool for long-term farm sustainability and profitability.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard in the region is to spread N fertilizer with a single dose on the entire plot

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The challenge is to manage nutrients in a more efficient way, and reduce water and soil contamination

How long did it take to implement the practice and which are the measures needed to monitor? By the moment there are very few farmers doing this. Many of them have the necessary tools to do it, but it is easier to work the conventional way.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - PRECISION NITROGEN MANAGEMENT USING HISTORICAL YIELD MAPS AND VARIABLE RATE TECHNOLOGY IN GRAIN CROPS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Leveraging drone technology for fertilizer optimization in tomato and corn crops

Greece

This practice integrates precision farming technologies, multispectral drone imaging, IoT soil and environmental sensors, and agronomic models, to optimize fertilization in organic open-field broccoli production. Unlike conventional methods in Greece, which rely on uniform application of compost or manure, it uses real-time monitoring to manage nutrient variability. Traditional approaches often cause uneven distribution, overuse in some areas, and deficiencies in others, affecting yield and sustainability. In contrast, this system enables precise, site-specific fertilization tailored to crop needs.

Multispectral drones capture high-resolution images to detect nutrient deficiencies, plant stress, and uneven growth. At the same time, IoT sensors continuously measure soil nutrients, moisture, temperature, and environmental conditions. These datasets are analyzed through agronomic models to generate fertilization schedules and variable application rates for each field zone. Farm Management Software (FMS) integrates all data and delivers clear, actionable recommendations, supporting efficient decision-making.

The approach improves resource efficiency, reduces nutrient leaching, and maintains soil health. By avoiding over-application, it limits runoff into water bodies and supports balanced nutrient cycling. It also promotes healthy soil microbiomes, essential for sustainable organic farming. These benefits are particularly relevant for broccoli, a crop with high nutrient demand and strong spatial variability.

A key advantage is the ability to provide early, actionable insights. Drone imaging can identify nutrient stress weeks before it becomes visible, allowing timely intervention and preventing yield loss. Continuous sensor monitoring replaces reliance on periodic soil tests, capturing critical changes throughout the season. This enables precise application of organic inputs only where needed, lowering costs and improving crop performance.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region? The standard practice in Greece, for fertilization in organic open-field vegetable production is a broadcast application of organic fertilizers such as compost, manure, or bio-based fertilizers, without precise targeting based on real-time monitoring. Nutrient application is often based on general recommendations or historical experience rather than real-time field conditions or crop-specific nutrient demands. Farmers may use periodic soil testing to guide fertilization decisions but lack access to advanced technologies like multispectral cameras, drones, IoT sensors, or agronomical models for precision nutrient management. This conventional approach, while suitable for organic farming regulations, often leads to inefficiencies, including uneven nutrient distribution, overuse in some areas, and nutrient deficiencies in others, ultimately impacting yield and environmental sustainability.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Links

STRATUS - Good Practices - Precision Farming - INTEGRATING
MULTISPECTRAL DRONE IMAGING, IOT SENSORS, AND AGRONOMICAL
MODELS FOR PRECISION FERTILISATION IN ORGANIC OPEN FIELD
VEGETABLE PRODUCTION

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

Localized application of nitrogen and phosphate starter fertilizers when sowing maize

France

Localized starter fertilizer application is used on 75% of maize acreage in France to improve nutrient efficiency and reduce environmental impacts. It consists of placing fertilizer directly near the seed at sowing, instead of broadcasting it across the field. Specialized equipment, such as seed drill attachment or precision applicators, deposits nutrients at a controlled depth and distance from the seed. This targeted placement enhances nutrient uptake, reduces waste and limits losses such as nitrogen volatilization.

The method improves plant access to key nutrients, especially in intensive systems or areas sensitive to nitrogen and phosphorus emissions. Localized nitrogen reduces volatilization, while phosphorus placement is critical due to its low mobility in soil and its role in early root development. This is particularly important for maize between the 3-leaf and 8–10-leaf stages, when root systems are still developing and phosphorus uptake is limited.

Application at sowing is recommended when residual soil nitrogen is below 60 kg/ha. A dose of around 40 kg/ha is generally sufficient to meet early crop needs up to the 10-leaf stage. Ensuring nutrients are available at the right time and place, the practice supports early growth and can improve yields while reducing environmental pressure.

Effectiveness can be enhanced through integration with precision farming tools such as GPS-guided seeders and soil sensors. Proper equipment calibration and accurate placement depth are essential for success. Farmers should monitor soil nitrogen levels, adjust application rates accordingly, and ensure compatibility between machinery and field conditions.

Although widely used in maize, the approach can be adapted to other crops, including cereals, potatoes, and vegetables, by adjusting placement techniques and nutrient doses to match crop-specific requirements. Overall, localized fertilization supports more efficient input use, better crop performance, and improved sustainability.

Additional information

IMPLEMENTATION PROCESS:

Which practice is considered as the standard in this region?

In this region, standard maize fertilization focuses on timing nutrient supply to match crop development. Nitrogen is mainly applied between the 4-leaf and 10-leaf stages, with the optimal window around the 6–8 leaf stage, when crop demand and uptake efficiency are highest. This timing supports rapid biomass accumulation while minimizing nitrogen losses. Phosphorus management is concentrated on

early growth stages (3-leaf to 10-leaf), when limited root development restricts nutrient uptake. Localized phosphorus application at sowing is commonly practiced, as it places the nutrient directly in the root zone, promoting early root growth and plant vigor.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice?

Localized fertilization using seed drill technology was adopted to overcome inefficiencies linked to conventional surface fertilizer applications. Surface spreading often results in nutrient losses through volatilization and leaching, increasing costs and reducing effectiveness. By placing solid or liquid starter fertilizers about 5 cm below and 4–5 cm to the side of the seed, nutrients are made readily available during early maize development. The use of formulations such as DAP 18-46-0 reduces the risk of ammonia toxicity while ensuring sufficient nitrogen and phosphorus supply. Advances in fertilizer formulations and improvements in seed drill technology, along with better market availability, made this practice practical and attractive to farmers.

How long did it take to implement the practice and which are the measures needed to monitor?

Localized fertilizer application at maize sowing has been available since 2008 and became widely adopted around 2012–2013. Effective implementation requires farmer training, accurate seed drill calibration,

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

[STRATUS - Good Practices - Precision Farming - LOCALIZED APPLICATION OF NITROGEN AND PHOSPHATE STARTER FERTILIZERS WHEN SOWING MAIZE](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

USING AND RETAINING CROP RESIDUES

Netherlands

Depending on the crop, crop residues can contain considerable amounts of nutrients. The nutrients are for instance stored in leaves, which are after being harvested left on the field. When degrading, those nutrients become available for soil organisms and the following crop. For instance the crop residues of sugar beets, a commonly grown crop in the Netherlands, leave over 50 kg N per hectare on the field after being harvested. However, those nutrients are often not considered when creating a fertilization strategy. The additional mineralized nutrients are prone to runoff. This research innovation quantifies the mineralization of nutrients out of crop residues and considers those during the following year in order to make a fertilization strategy that considers all the available nutrients, not only those applied but also the ones that become available in the soil throughout the year.

IMPLEMENTATION PROCESS

Which fertiliser type is considered as the standard in this region? Depends on the crop. This can often be a basic fertilization with slurry with an additional artificial fertilizer.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The mineralization rate is uncertain, as it depends on many factors such as tillage intensity and weather circumstances.

How long did it take to implement the practice and which are the measures needed to monitor? Depending on the strategy. Taking samples would take a few hours per month, basing the numbers on literature hours per year.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - USING AND RETAINING CROP RESIDUES

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

CUT&CARRY FERTILIZERS

Netherlands

Cut and carry fertilizers are organic fertilizers produced from plants. Those plants are often leguminous species. The plants are grown in one place and after being harvested transported to another location and applied as fertilizers. In between they might be dried and processed into grains. The growing of the fertilizing crops is often done on less arable fields. Once they are mature, they are brought to agricultural areas where they can contribute to soil fertility. Such a cropping system can result in plant-based fertilization strategies that reduce the need of animal or artificial fertilizers. The production and application lead to less direct greenhouse gas emissions. By adding considerable amounts of organic matter, the fertilization strategy can contribute to enhancing the soil structure, supporting soil life and if applied in the form a mulch layer plant-based fertilizers can reduce weed pressure. A downside of this technique is the land requirements, as external land is required for the mineral input in other regions. Therefore, less fertile soils are often used for this method. Additionally, the approach can be costly as it requires additional land and transporting materials that have a relatively low nutrient density.

IMPLEMENTATION PROCESS

Which fertiliser type is considered as the standard in this region? Depends on the crop. This can often be a basic fertilization with slurry with an additional artificial fertilizer.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Fertilization strategies are often based on the application of mineral fertilizers. Also the application of slurry, which comes from animals, is often based on grass that was fertilized with mineral fertilizers. To reduce the dependency on mineral fertilizers, cut & carry fertilizers can be applied.

How long did it take to implement the practice and which are the measures needed to monitor? Multiple years, as you need time for the nutritional crop

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - CUT&CARRY
FERTILIZERS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

PIG SLURRY COMPOSITION ANALYSIS

Spain

Since 2022, it is mandatory in Spain to have a recent product analysis when applying organic fertilizers. However, this is not yet a common practice among farmers. Pig slurry, as a widely used organic fertilizer, play an important role in the fertilization strategy of many farmers. Understanding the nutrient content of pig slurry is important for the nutrient management. However, without knowing a nutrient analysis it is not possible to know the nutrient content of the slurry. This increases the risk of either over or underfertilizing the field. Underfertilizing the crop might prevent the crop reaching its yield potential. Yet, overfertilizing might result in negative externalities due to environmental risks. By analysing the composition of pig slurry, farmers can adjust their mineral fertilization strategies more accurately and adjust the artificial fertilizer gift accordingly.

IMPLEMENTATION PROCESS

Which fertiliser type is considered as the standard in this region? As nitrogen fertilizer the standard in the region is Urea 46%

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? When trying to adjust or reduce nitrogen fertilization, it is important to know beforehand the amount of nitrogen we will apply when using a specific organic product.

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

Geographical location

Spain, Poland, Greece, Slovenia, Netherlands, France, Latvia, Hungary, Italy, Belgium, Sweden

Project Keywords

Links

[STRATUS - Good Practices - Bio-Based Fertilizers - PIG SLURRY COMPOSITION ANALYSIS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

MANAGING NUTRIENT AVAILABILITY RATE FROM MUNICIPAL SLUDGE

Spain

Municipal sludge is a large source of nutrients. Unlike other organic fertilizers, municipal sludge has a stable composition, enabling precise adjustments to mineral fertilization. Nitrogen in organic fertilizer is available in different ways and depending on which one is prevailing, products need to be managed in one or another way. For years field trials with these products have been developed, leading to a better understanding of the nitrogen availability during years after application. The aim is to raise awareness among farmers about reducing mineral nitrogen fertilization when using municipal sludge.

IMPLEMENTATION PROCESS

Which fertiliser type is considered as the standard in this region?

Nitrogen: Urea 46%.

Phosphorus: TSP 45%

Potassium: KCl 60%, but it is not applied to cereals in our region as soil has high potassium contents

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Farmers usually apply municipal sludge in our region as it is a cheap fertilizer (they don't pay for it), but most of them are not aware of the amount of mineral N they can save when applying this product.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - MANAGING NUTRIENT AVAILABILITY RATE FROM MUNICIPAL SLUDGE

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

SCRUBBING OF STABLE AIR TO PRODUCE AMMONIUM SULPHATE

Belgium

Emissions of NH_3 from livestock housing and slurry storage represent a large part of the total NH_3 emissions from agricultural activities. Therefore chemical air scrubbing is used to reduce the ammonia and odor components in stable air. Water with added sulfuric acid is used to stream along the filter package. The acid washwater reacts with the ammonia in the stable air, producing ammonium sulphate which remains in the washwater. To optimally work the washwater needs to be removed regularly. This washwater can be used as a recuperated fertilizer and is recognized as a substitute for synthetic fertilizer. The resulting fertiliser is liquid and can be applied as any other liquid fertilizer through injection or through spraying followed by immediate ploughing. Applications where the fertiliser is brought as close as possible to the roots is ideal. This fertiliser is best applied at the start of the growing season because the N in the product is present as ammonium and it still needs to be converted to nitrate before the plant can absorb it. This type of fertiliser is useful for any kind of crop, but in case a S containing counter acid is used in the production step the resulting fertiliser can be of particular interest for crops that also have a sulfur need such as cabbage crops, onions, celery, grains, sugar beets etc.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? Mineral fertilizer and/or pig manure

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The need to reduce emissions from stable air.

How long did it take to implement the practice and which are the measures needed to monitor? Need for permits + regular monitoring + obligatory analyses on frequent basis.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

Geographical location

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - SCRUBBING OF STABLE AIR TO PRODUCE AMMONIUM SULPHATE

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

STRIPPING-SCRUBBING OF LIQUID FRACTION OF PIG MANURE TO PRODUCE AMMONIUM NITRATE

Stripping-scrubbing of the liquid fraction of pig manure allows for on farm production of biobased fertilizer. It starts with the liquid fraction of pig manure followed by scrubbing for ammonium salt recuperation.

The operating principle of stripping-scrubbing is that ammonia (NH_3) is stripped by air, steam or vacuum through the nitrogen rich waste stream in an NH_3 stripping reactor, resulting in NH_3 transfer from the aqueous phase to a gas phase. The released NH_3 is removed in a chemical air scrubber by washing it with a strong acidic solution such as nitric acid (HNO_3), resulting in ammonium nitrate. The efficiency of process can be increased by adjusting the pH and/or temperature by which more of water soluble $\text{NH}_4\text{-N}$ ion will be converted into the gaseous ammonia.

The resulting fertiliser is liquid and can be applied as any other liquid fertilizer through injection or through spraying followed by immediate ploughing. Applications where the fertiliser is brought as close as possible to the roots is ideal. This fertiliser is best applied at the start of the growing season because the nitrogen in the product is present as ammonium and it still needs to be converted to nitrate before the plant can absorb it. This type of fertiliser is useful for any kind of crop, but in case a S containing counter acid is used in the production step the resulting fertiliser can be of particular interest for crops that also have a sulfur need such as cabbage crops, onions, celery, grains, sugar beets etc.

As this fertiliser has an acidic character special attention should be paid to the material use when applying this fertiliser. Also, at any time the mixture with animal manure should be avoided as toxic H_2S formation could occur.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? Mineral fertilizer and/or (pig) manure (slurry)

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

Main funding source

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - STRIPPING-
SCRUBBING OF LIQUID FRACTION OF PIG MANURE TO PRODUCE
AMMONIUM NITRATE

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

GUARANTEED LEVEL OF NUTRIENTS MANURE PRODUCTS

Netherlands

To ensure optimal nutrient use, it is important to guarantee the nutrient levels in animal manure before application. This approach is especially relevant for slurry and other processed forms of biobased fertilizers. By precisely determining the nutrient composition, farmers can supply nutrients based on the crop and soil need. This is currently not the case due to reliance on assumed nutrient values. This practice applies to all crops where animal manure is used.

Farmers often turn to artificial fertilizers to make specific adjustments in nitrogen or phosphate levels. However, with guaranteed nutrient levels in animal manure, these adjustments can also be made using manure, reducing reliance on synthetic fertilizers. Achieving this requires on-farm measurement equipment capable of providing fast and accurate nutrient analysis directly in the manure storage. Before application, an additional measurement should be taken by the arable farmer, for example using near-infrared (NIR) technology. More information about this can be found in the precision farming GP about NIR.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? Organic manure (assumed nutrients) & artificial manure.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The challenge: the animal manure space is not used to its potential. In the ideal world the use of artificial fertilizer will be very much limited. To manage this, nutrient levels of animal manure should be known, so the animal manure space can be used to its full potential.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Project Keywords

Links

[STRATUS - Good Practices - Bio-Based Fertilizers - GUARANTEED LEVEL OF NUTRIENTS MANURE PRODUCTS](#)

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

AGRICYCLING: REGIONAL USAGE

Netherlands

This good practice is inspired by a collaboration between farmers with a partnership with governments, and nature organizations called Agricycling. However, the initiative can be applied in many other places. It focuses on reusing available residual streams from society, such as roadside grass, by delivering them directly to farmers for composting. This process optimizes the use of residual streams from a soil perspective and uses the streams based on what the soil and plant needs. This can serve as an addition to or replacement for existing fertilization. The application process is data-driven and begins with analyzing the residual streams to assess their mineral composition and organic matter content. Based on this analysis, decisions are made about how to distribute the compost across farms. At the farm level, a soil analysis determines the specific application, ensuring it is done at the right time and place and in line with the needs of the soil and crops. This tailored approach provides to a sustainable alternative or addition to traditional fertilization, strengthening the connection between urban waste management and agricultural productivity. This results in both economic and ecological benefits, as it reduces fertilizer costs, while increasing soil fertility and reducing the need of mineral fertilizers.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? Animal based fertilizer and chemical fertilizers

How long did it take to implement the practice and which are the measures needed to monitor? At least one year, to get all parties involved and aligned, quality protocols in place and have the practice starting.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

Geographical location

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - AGRICYCLING:
REGIONAL USAGE

AgriCycling

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

SOLID FRACTION OF A DIGESTATE FROM PLANT MATERIAL

France

Digestates are the majority by-product of methanization. They are rich in organic and mineral elements, giving them a high organic fertilizer potential. The spreading of digestates, particularly of agricultural origin, is the most commonly carried out practice in order to valorize this product. Physicochemical and agronomic indicators are used in order to quantify their characteristics and qualities. The characteristics of digestates are very variable and depend on several factors such as inputs, operating conditions of methanizers and post-treatments. Here we propose the solid fraction of a digestate, mainly from plant matter, and supplemented with non-ruminant slurry and ruminant slurry.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? Green waste compost

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The methanization sector has been developing rapidly in France for about ten years. This sector meets the needs of waste treatment, increased energy autonomy and energy decarbonization. But it also provides positive externalities, digestate. For the agricultural world, digestate is now considered a real product. It provides farmers who use it with a real technical and economic benefit. It also represents considerable potential for savings on synthetic nitrogen fertilizers.

How long did it take to implement the practice and which are the measures needed to monitor? In order to optimally use digestates, the first step is to know the products that will be spread. Indeed, digestates vary greatly depending on the method of methanization (dry or wet), the inputs and the post-treatments applied. The principle of fertilization balance, applicable to all fertilizers, also applies to digestates. The objective is to ensure that the crop's needs are covered by the soil and by digestates.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - SOLID FRACTION OF A DIGESTATE FROM PLANT MATERIAL

Fertiliser Avec Des Digestats - calculation methodsnd

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

USE OF DIGESTATE ORIGINATING FROM SMALL SCALE FARM DIGESTION

Belgium

Small-scale anaerobic digestion of residual flows (mainly at dairy farms) can help the farmer to fulfil the electricity needs of the farm and partly the heat demand through combustion of biogas in a combined heat and power unit. It has a local character and limited scale as compared to a larger digester. As a “waste stream” the resulting digestate can be used as a fertilizer. It can be used and spread in a similar way as classic manure but has environmental advantages. Under default practices animal production causes significant amounts of methane slipping from manure storage. By first putting manure in anaerobic digestion this methane slip is avoided and even captured into a renewable resource. This way the carbon footprint of (dairy) farms is reduced. Furthermore, during the AD process the nutrients from the animal manure are mineralized rendering them more plant available and thus increasing their nutrient use efficiency.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? Mineral fertilizer and/or pig manure (slurry)

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Horizon Europe (EU Research and Innovation Programme)

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - USE OF DIGESTATE
ORIGINATING FROM SMALL SCALE FARM DIGESTION

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

OPTIMIZING FERTILIZATION BY USING NON-MICROBIAL BIOSTIMULANTS

Biostimulants aim to improve the effectiveness of fertilization, the efficiency of plant nutrition. Their use is rather preventive. A plant biostimulant is a product that stimulates plant nutrition processes independently of the nutrients it contains, with the sole aim of improving one or more of the following characteristics of plants or their rhizosphere: a) nutrient use efficiency; b) tolerance to abiotic stress; c) qualitative characteristics; d) availability of nutrients confined in the soil and rhizosphere. The biostimulants are made from a variety of natural sources, including plant extracts, microbial cultures and animal byproducts. They can be processed in different ways, by for instance being fermented, which are then formulated into products that can be applied on the fields.

Additional information

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? This practice can be compared to fertilization without the use of biostimulants, since the aim of this BBF is to optimize conventional fertilization.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice?

1. Nutrient Use Efficiency and Fertilizer Management Challenges: Challenge: One of the main on-farm challenges is optimizing the use of chemical fertilizers. Over-fertilization can lead to nutrient imbalances, environmental pollution (e.g., water contamination), and inefficient nutrient uptake by plants. Farmers face growing pressure to reduce fertilizer use while maintaining or even improving crop yields. Opportunity: Biostimulants improve the efficiency of nutrient uptake by plants, enabling them to use available nutrients more effectively, even in soils with suboptimal fertility. By enhancing nutrient use efficiency, biostimulants help reduce the need for chemical fertilizers, lowering costs and environmental impacts.
2. Abiotic Stress and Climate Variability: Challenge: Farmers are increasingly dealing with climate change-related stresses, such as drought, heatwaves, and flooding, which reduce crop resilience and productivity. Crops that are stressed by extreme weather conditions often show reduced nutrient uptake and growth. Opportunity: Biostimulants have been found to enhance plant tolerance to abiotic stress by improving cellular functions, promoting root growth, and boosting plant defence mechanisms. For instance, some biostimulants help plants cope with water scarcity by increasing root depth and efficiency, which is crucial in drought-prone areas.

How long did it take to implement the practice and which are the measures needed to monitor? 1 or 2 years

SOURCE PROJECT

AdviSor neTwork foR OptimAI ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - OPTIMIZING FERTILIZATION BY USING NON-MICROBIAL BIOSTIMULANTS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

THE USE OF BIOCHAR IN GROWING MEDIA FOR SOILLESS CULTIVATION IN HORTICULTURE

Belgium

Growing media include any materials other than soil used as a horticultural substrate for plant rooting and cultivation in a confined volume, as part of controlled environment agriculture. These growing media are used for growing vegetables, fruits and ornamentals in a range of hydroponic systems in greenhouses. Peat is widely used as major constituent in growing media but is controversial due to damage to peatlands and greenhouse gas emissions at harvesting.

Biochar can be used in growing media blends as fertilizer or for improving plant growth, disease suppression, and as a sustainable (partial) replacement of peat. Biochar is one of the products of pyrolysis, i.e., heating of biomass with no or limited presence of air. It can be produced from a wide variety of feedstocks, ranging from lignocellulosic materials (as wood, reed, and grass) to nutrient rich waste streams as manure.

Biochar contains nutrients originating from the feedstock, which can potentially be released by use in growing media. Next to that, biochar addition can alter the pH of the growing media, which influences nutrient mobility and availability.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? In general, peat-based growing media are used.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? The use of peat in growing media is getting more and more controversial due to the high environmental impact of peat harvesting from wetlands.

SOURCE PROJECT

AdviSor neTwork foR OptimAl ferTilisers Use

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - THE USE OF BIOCHAR
IN GROWING MEDIA FOR SOILLESS CULTIVATION IN HORTICULTURE

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

FERTIBIO DEVELOPMENT OF THE PRODUCTION PROCESS OF BIO-FERTILIZERS

Italy

The biofertilizer contains primarily of beneficial microorganisms, including arbuscular mycorrhizal fungi (AMF), bacteria, and other fungi. These microorganisms are produced in vitro, in axenic cultures, and in vivo, resulting in effective inoculants. The AMF included in the biofertilizer belong to species such as Funneliformis mosseae, Rhizophagus irregularis, and Archaeospora spp., which have been isolated, multiplied because of their effectivity and efficiency.

The fertilizer is delivered in the form of alginate-based capsules containing the inoculum, which includes spores, hyphae, and colonized roots, as well as phosphate-solubilizing bacteria capable of making phosphorus more accessible.

It is suitable for use on crops such as wheat, barley, sunflower, tomato, chickpea and alfalfa. Application is most effective directly after planting or during early crop stages to maximize the interaction between the microorganisms and plant roots. The biofertilizer stimulates nutrient uptake efficiency and supports crop growth. This way, the biofertilizer can be a potential to mineral fertilizers.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? All kind of fertilizer, chemicals and organic fertilizers

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Biofertilizers, efficient in conventional agriculture, can be used effectively to reduce the use of mineral fertilizers and pesticides with a positive environmental impact on soil fertility and the diversity of agroecosystems.

SOURCE PROJECT

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Project Keywords

Links

STRATUS - Good Practices - Bio-Based Fertilizers - FERTIBIO
DEVELOPMENT OF THE PRODUCTION PROCESS OF BIO-FERTILIZERS

PRACTICE ABSTRACT - RESEARCH AND INNOVATION

BIOCHAR: INNOVATIONS THROUGH CARBONIZATIONS TESTED IN AMIATA AND MAREMMA

Italy

Biochar is a carbon-rich material produced by pyrolysis, which is the thermal decomposition in the absence of oxygen. This usually occurs in organic biomass, such as wood, agricultural residues, or other plant materials. It is primarily used as a soil amendment to improve soil health and sequester carbon. Biochar is usually applied during soil preparation and is either before or after seeding incorporated in the soil.

It can be applied in combination with an organic fertilizer, like compost or slurry.

By adding biochar to a soil, the carbon content is increased which contributes to the overall soil fertility. Specifically, the addition of biochar increases the water holding capacity of the soil. Next to that, it is a stimulus for soil life and can reduce the leaching by binding nutrients.

The biochar can be produced of many carbon rich products. In this project the experimentation was conducted on biochar obtained from the combination of forestry, agro-forestry, olive-growing, and agriculture. In particular, the aim is to reduce the waste out of olive pruning. This is particularly interesting from a circular economy perspective which, through vegetal the production of biochar, transforms what was previously a problem into a resource.

IMPLEMENTATION PROCESS:

Which fertiliser type is considered as the standard in this region? It depends on the cultivation and it may be chemical or organic

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Valorize waste and processing residues with less impact than other forms of disposal and at the same time generate energy and increase in the fertility of the "soil system".

How long did it take to implement the practice and which are the measures needed to monitor? 29 Months

SOURCE PROJECT

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Project Keywords

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[STRATUS - Good Practices - Bio-Based Fertilizers - BIOCHAR: INNOVATIONS THROUGH CARBONIZATIONS TESTED IN AMIATA AND MAREMMA](#)



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