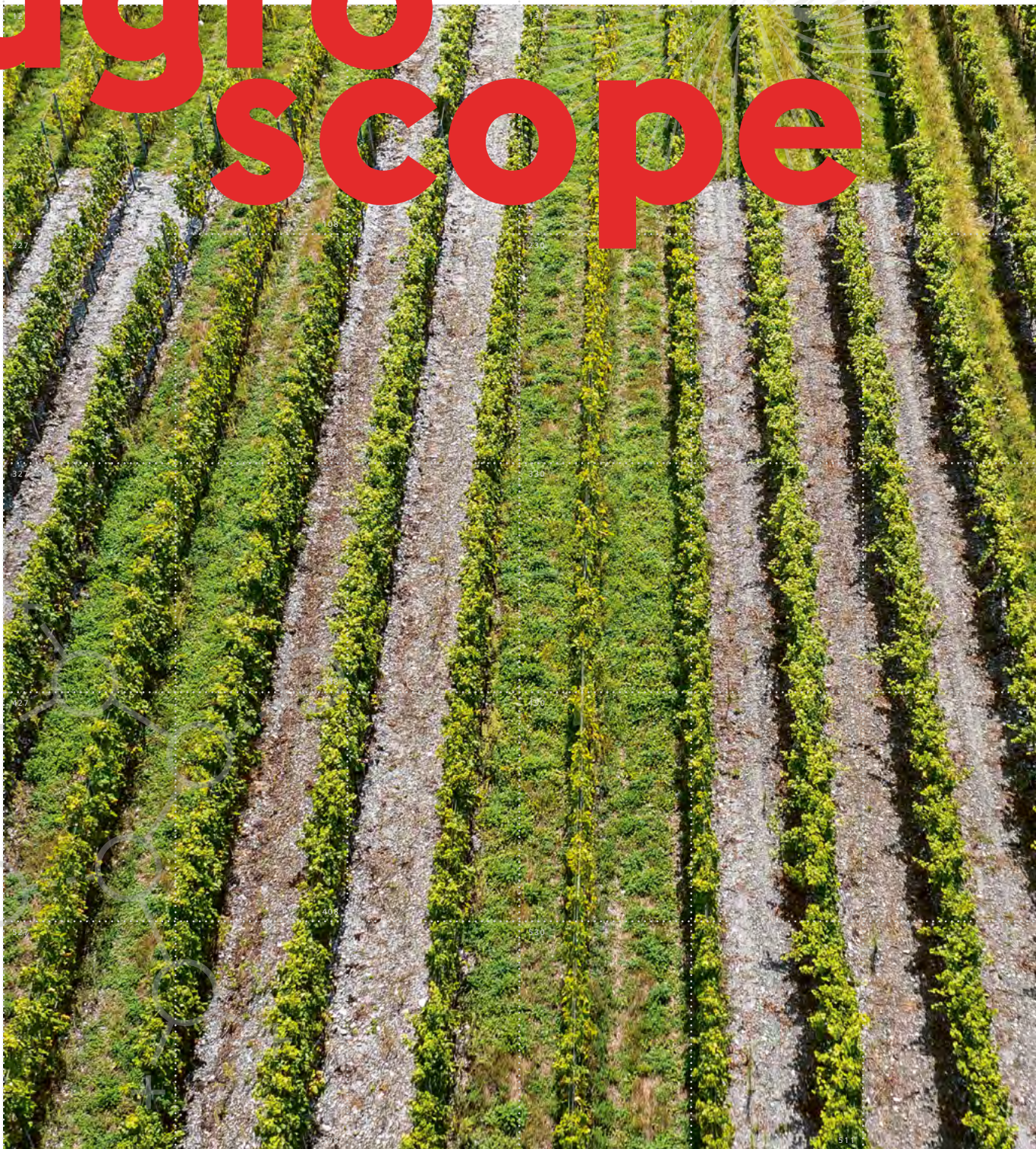


March 2024

# agroscope



Agroscope good food, healthy environment



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Federal Department of Economic Affairs,  
Education and Research EAER

**Agroscope**



How does soil management in vineyards affect wine quality?  
Agroscope supports commercial farms and processing operations with scientific studies, e. g. in sustainable viticulture, to answer these and other questions ([see article, pp. 6–7](#)).



## Dear readers,

To ensure the quality and safety of foodstuffs across the entire value chain – from field to shop – Agroscope supports commercial farms and processing facilities as well as the involved federal and cantonal agencies with scientific studies. For example, our researchers study whether various soil management methods in vineyards influence the quality of the wines. For more on this topic, read the first article in this issue – ‘Impact of Soil Management Methods in Vineyards’ ([page 6](#)).



Consumers not only wish for food of impeccable quality, however, but also want products to be produced with reduced plant-protection product use. New disease-robust varieties make it easier to comply with this wish. Read our portrait of breeding researcher Kevin Gauthier ([page 12](#)) to see how this is achievable for wheat and oilseed rape.

Besides the safety and quality of our food, however, two of the most important challenges facing us today are the protection of natural resources and security of supply. The avoidance of food waste can make an important contribution here. The article ‘Using Former Food Products as Pig Feed Reduces Food Waste’ ([page 10](#)) describes a sensible solution to this problem. Similarly, the articles ‘The Challenge of Nutrient Losses – Agroscope Supports Agricultural Practitioners’ ([page 18](#)) and ‘Community rather than Individual Farm Goals for Climate Change Mitigation’ ([page 20](#)), describe how researchers have developed new fact-based, expedient approaches for the attention of practitioners and agricultural policy-makers.

Wishing you an interesting and informative read.

Fabian Wahl

Head of the ‘Food Microbial Systems’ Strategic Research Division



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Agroscope is the **Swiss Centre of Excellence for Agricultural Research**, and is affiliated with the Federal Office for Agriculture (FOAG). Agroscope makes an important contribution to a sustainable agriculture and food sector as well as to an intact environment, thereby contributing to an improved quality of life.

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# Events

7 – 8 May 2024,

Agroscope, Bern-Liebefeld

## D-A-CH Algae Summit 2024

Latest developments in algae-related research and the algae industry

3 – 12 May 2024,

BEA Bern, 'Grünes Zentrum'

## Agroscope is taking part in a special exhibition entitled "Swiss grains – natural, healthy, sustainable"

2 June 2024,

Agroscope, Stone Fruit Centre Breitenhof

## Agroscope Breitenhof Conference 2024

The meeting place for the stone-fruit sector

11 June 2024,

Agroscope, Bern-Liebefeld

## Cheese & Science

17 August 2024,

Agroscope, Pilot and Training Plant Göttingen

## Göttingen Conference 2024

[All Agroscope events that are open to the public are advertised on our website.](#)

# Making the Best Use of Strictly Limited N Fertiliser

Cyril Tappolet produces cereal seed on his farm in Schaffhausen, where he is field-testing site-specific fertiliser application. He is surprised how easy it is.



[Smart Technologies](#)  
[Experimental Station \(in german\)](#)



"I often get comments and questions from passers-by when I'm fertiliser spreading, and I'm keen to show people that I'm using the latest technologies. With the 10% tolerance margin for nitrogen applications being withdrawn in 2024, I had been wondering how to make the best use of the strictly limited fertiliser inputs. The Smart-N project (see box) came at just the right time for me.

I was pleasantly surprised just how easy it is. I create the application map using the software, pop it on a USB stick and transfer it straight to the tractor's terminal. The fertiliser spreader automatically applies the calculated doses at the right place. This technology is already used on many farms abroad.

However, you do have to familiarise yourself with the subject matter, which may be a barrier to some. Farmers need support and motivation to encourage them to use this system. In Switzerland, site-specific spreading is not worthwhile purely on financial grounds because our fields are simply too small, but I like working with this technology. It allows me to make optimum use of the available nitrogen to supply all plants optimally and produce the maximum number of viable seeds."

### **Lower nitrogen losses thanks to smart fertilising**

The Smart-N project run by the Smart Technologies Experimental Station has shown that variable-rate fertilisation can reduce nitrogen losses in winter wheat by up to 22% without adversely affecting yields or quality. The project combines satellite images with soil and weather data to calculate precisely where and how much nitrogen is required.

## **News from the Other Experimental Stations**

### **► UV-C-Robot Combats Powdery Mildew in Strawberries**

At night he drives unattended through the foil greenhouses treating the strawberry plants with UV-C rays: Agroscope is testing an innovative robot at a producer's in eastern Switzerland that could be a worthwhile alternative to plant-protection product use.



### **► A Close Look at Swiss Alpine Pastures**

The vegetation of Swiss alpine pastures is exceptionally rich and varied. The initial vegetation analyses on 14 alps highlight the high degree of specialisation of these plants.



[Further information on the experimental stations](#)

# Impact of Soil Management Methods in Vineyards

Soil management lies at the heart of major global warming and sustainable viticulture issues. In this context, inter-row plant cover in vineyards comes with its share of benefits and drawbacks.

**Vivian Zufferey, Nicolas Delabays, Thibaut Verdenal, Jean-Sébastien Reynard, Agnès Dienes, Sandrine Belcher, Fabrice Lorenzini, Stefan Bieri, Marie Blackford, Gilles Bourdin, Jorge E. Spangenberg, Christoph Carlen, Jean-Laurent Spring**



Plant-cover trial at Agroscope's vineyard in Changins.



A trial comparing different maintenance strategies and soil covers in inter-rows was conducted for three years from 2019 to 2021 on Agroscope's Changins site. The study compared a chemically cleared plot (bare soil) to three permanent herbaceous covers: spontaneous natural grass cover, the sowing of a standard vineyard mixture (UFA2) and the sowing of an MCS4 mixture composed of less vigorous, and hence potentially less competitive species.

### **Different plant covers**

With the 'regularly cleared' approach, the soil remains bare during the summer periods. With the 'spontaneous grass cover' approach, however, the ground remains continuously covered from the first spring onwards. The vegetation, which is furthermore quite ordinary, does not contribute to biodiversity promotion. The standard vineyard mixture (UFA2), for its part, facilitates the rapid establishment of good soil cover, but is no better at improving biodiversity. Lastly, the MCS4 mixture yields a less competitive permanent cover and achieves at least quality level I in terms of biodiversity promotion.

### **Impact on vine yield and vigour**

Although annual rainfall varied from one year to the next, the vines were not subject to significant water stress over the three years of the study. In these conditions, the natural or sown grass cover of the inter-rows did not exert a major influence on yield components such as bud fertility, berry and bunch weight and shoot vigour compared to the chemical clearing of the ground.

### **Berry composition**

Berry composition (sugar levels, pH, total acidity, tartaric and malic acid) at harvest was the same, regardless of the soil maintenance approach pursued. The 'natural' or 'sown' grass cover approaches resulted in a decreased berry assimilable nitrogen content compared to that of

the 'no grow' ('bare soil') approach. Berry NH<sub>3</sub> and primary amino acid ( $\alpha$ -amino acid) content were lower than in the 'grassed-over' (grass cover) variants.

### **Sensorial analysis of the wines**

Conducted two months after bottling, the sensorial analysis of the wines failed to identify any olfactory or gustatory differences between the three 'grassed-over' (grass cover) variants and the 'bare soil' variant throughout the 2019 vintage. In 2020, however, the wines produced from the 'grassed-over' variants with the 'MCS4' and 'UFA vineyard' mixtures exhibited slightly higher bitter notes as well as a more subdued bouquet than those of the 'spontaneous grass cover' and 'bare soil' variants. In 2021, the wines from the 'cleared' ('bare soil') variant were preferred at tastings. Furthermore, no olfactory or gustatory differences were noted between natural grass cover and sown grass cover in the inter-rows. —

### **Conclusions**

- ▶ Natural grass cover and sown grass cover with the 'MCS4' and 'UFA vineyard' mixtures resulted in a decrease in the berry nitrogen composition at harvest, i.e. lower NH<sub>3</sub>, lower primary amino acid ( $\alpha$ -amino acid) content and, lastly, lower assimilable nitrogen content compared to the 'no grow' ('bare soil') variant.
- ▶ In the absence of water stress, the yield components (bud fertility, berry and bunch weight) and shoot vigour were the same, regardless of the soil management method used.
- ▶ The different soil management methods did not significantly influence berry composition such as sugar content, pH, total acidity and tartaric and malic acid content.
- ▶ The wines from the 'grassed-over' variants were judged to be slightly more bitter and with a more subdued bouquet than those from the 'no grow' ('bare soil') variant.
- ▶ The breeding, establishment and maintenance of less competitive species for grassing-over vineyard plots will require further in-depth investigations.

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[Scientific publication:](#)  
[Swiss Agricultural Research 15, 38-46, 2024](#)



### ► **Measuring Soil Fertility Directly in the Field**

Soil samples can be measured directly in the field by means of spectroscopy. Agroscope researchers have tested mobile devices and shown how to make the best use of them.

→ [Video](#)

### ► **Virtual Fencing without Long-Term Stress for Cows**

Agroscope researchers tested a virtual fencing system that delimits the pastures without a physical barrier, using acoustic and electrical signals only.

→ [Video](#)

### ► **Soil Atlas Depicts the Distribution of Chemical Elements in Swiss Soils**

Agroscope and the Federal Office for the Environment have published the first Geochemical Soil Atlas of Switzerland. Providing an overview of the large-scale distribution of 20 naturally occurring chemical elements in Swiss soils, the atlas will enable the assessment of soil pollution levels and identify where action is necessary.



### ► **Practical Information on Plant Protection in Fruit Production 2024 Published**

The Resources List and the Plant Protection Recommendations provide detailed information on products, dosages and target organisms as well as describing pathogens, control methods and the general use of plant-protection products. Both publications are available free of charge online.



### ► **Swiss Symposium for Nutritional Research: Approaches to a Sustainable Diet and Metabolic Health**

Over 120 nutritional researchers from all over Switzerland exchanged views at the first Swiss Symposium for Nutritional Research in Bern on the effects of diet on metabolic health and sustainability.



### ► **11<sup>th</sup> Agroscope Sustainability Conference**

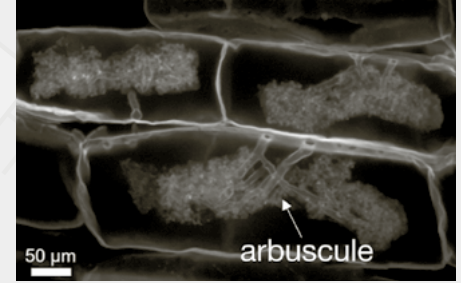
Based on the topic 'Micro-organisms – Hardworking Helpers from Field to our Bodies', the Agroscope Sustainability Conference took place on 25 January 2024. The presentations and impressions of the conference are online.

→ [Presentations](#)



► **Extending the Productive Life of Dairy Cows: Who Has a Say?**

Which stakeholders in the dairy sector have an influence on the productive life of dairy cows? Research results from FiBL and Agroscope suggest that broad-based cooperation is needed to create structures for a longer productive life.



► **Predictable yield increases thanks to mycorrhizal fungi inoculation in maize**

Researchers were able to show that inoculating maize fields with mycorrhizal fungi can increase harvest yields. In addition, indicators were found for predicting the success of the measure. The findings were published in the scientific journal Nature Microbiology.



► **More income from Grass-Based Beef Production**

Agroscope studied how grass-based farms can produce both economically and in an ecologically sound manner. Find out more in the video and in the article published in Swiss Agricultural Research.

→ [Video](#)



► **Mineral Oil Hydrocarbons in Dairy Products – Identifying and Taking Measures to Avoid Input Sources**

For some time now, mineral oil hydrocarbons in foods have been the subject of intense discussion. In this factsheet, we give an overview of input sources and benchmarks for different dairy products as well as an introduction to the interpretation of laboratory data.



► **Fertilisation Recommendations for Vegetable Production Updated**

The Principles of Fertilisation (PRIF) are of great importance for agricultural practitioners and extension. Agroscope has now updated and expanded the 'Fertilisation in Vegetable Production' module.

→ [Further News Topics](#)

# Using Former Food Products as Pig Feed Reduces Food Waste

Food that is unsuitable for human consumption does not affect the growth performance or carcass composition of pigs to which it is fed. This makes it a promising solution for reducing food waste.

**Sharon Mazzoleni, Marco Tretola, Alice Luciano, Peng Lin, Luciano Pinotti, Giuseppe Bee**



Former food products in pig feed reduces food waste and improves the environmental performance of food production.

Owing to defects, certain foodstuffs are no longer suitable for human consumption. They are, however, edible for animals, and remain useful sources of energy and nutrients such as easily digestible cooked starch, simple sugars and fats. An Agroscope study has shown that such food waste ('former food products' or FFPs) can be converted into animal feed, replacing up to 30% of the grain in the diet of growing and finishing pigs with no detrimental effect on growth performance or carcass quality.

In this study, researchers examined the effect of savoury and sweet former food products (FFPs) on the growth performance, feed digestion, body composition and carcass composition of growing-finishing pigs.

Thirty-six Swiss Large White castrated male pigs were assigned to three groups. The first group (ST) was fed a standard grain-based diet. In the second group (SA) and third group (SW), 30% of the ration was replaced by savoury FFPs (pasta, bread and savoury snacks) and sweet FFPs (chocolate, breakfast cereals and cookies), respectively.

### **Growth performances unchanged when FFPs fed**

Feed efficiency in terms of feed conversion ratio was significantly higher in pigs fed a standard diet during the growth period than in pigs fed an alternative diet. If, however, the finishing period is also considered, then body weight, average daily intake, average daily gain (ADG) and feed conversion ratio were similar in the three groups.

Total apparent digestibility of crude energy was higher in the SA group than in the ST group during both growth

and finishing. During the finishing period, the total apparent digestibility of crude fibre was higher in the ST group than in the SA and SW groups.

### **Savoury and sweet FFPs have no impact on carcass quality**

Over the entire period, average daily fat intake was significantly higher in pigs fed an SW diet. Despite this, the two alternative diets did not significantly affect parameters associated with the body composition of the pigs. Total carcass fat content was similar between the groups, although the carcass of the SW group had the thickest belly fat. —

### **Conclusions**

- ▶ Replacing up to 30% of pigs' diets with foodstuffs that are no longer suitable for human consumption (former food products or FFPs) does not have detrimental effects on growth performance during the growth and finishing stages.
- ▶ Whilst the total fat content of the carcass was not affected by the feeding of these FFPs, the pigs fed sweet products had thicker belly fat than those fed savoury products.
- ▶ Recycling savoury and sweet FFPs in pig feed represents a worthwhile approach to reducing resource wastage and mitigating the environmental impact of food production.

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[Scientific publication:](#)  
[Animal 17 \(101019\), 1-10, 2023](#)

# Discovering New Varieties and Making Them Available to Practitioners



**Kevin Gauthier researches disease-resistant parental varieties and resistance genes for wheat and soybean to make them available to breeders. In doing so, the thirty-year-old pursues a clear goal.**

Since April 2023, Kevin Gauthier has worked at Agroscope as a so-called pre-breeder for disease resistance in wheat and soybean. He identifies disease-resistant parental varieties and resistance genes for wheat and soybean and recommends them to variety breeders. The 30-year old native-born Frenchman from Annecy describes his motivation thus:

“I’d like to help curb global hunger

crises with new, disease-resistant varieties that are adapted to the local conditions.”

## **First successes in two projects**

After studying Agronomy in France and an Erasmus exchange that took him to Germany, Gauthier earned his Master’s in Sweden. For his doctoral thesis on grain viruses he went back to his native France, to the INRAE in Montpellier. He then moved to the Julius-Kühn Institute in Germany to study soilborne viruses. In the end, he was drawn by the applied research conducted at Agroscope. Kevin Gauthier is involved in two projects that have

already chalked up their first successes: the SANSCARIE project in collaboration with Delley Seeds and Plants Ltd. and Getreidezüchtung Peter Kunz (GZPK), and the GWAS project. Both projects enabled the identification of varieties or genome domains that are resistant to common bunt or to yellow and brown rust of wheat.

## **Cultivating site-specific varieties**

Kevin Gauthier’s work is his passion. “Discovering something new and then making it available to practitioners through extension” is a particular motivator. Specialists from the cantonal extension services, for example, send him reports and samples associated with disease outbreaks. He identifies the pathogen in the laboratory. In addition to reporting his findings, he makes recommendations: “The aim is to grown the varieties that are best adapted to the site; that way we’ll have disease-resistant varieties providing good yields and a high quality harvest, which is exactly what practitioners want.”. —



## INSIGHTS

Impressions of current applied research activities for the agriculture and food sector.



- 1 Harvest of the 'breeding of forage plants' bioassay.
- 2 Pollination by wild bees.
- 3 Lab work at Agroscope's Posieux site.



Archive photo: hay harvest.







1



2



3



- 1 Testing soil quality.
- 2 The forage plant, sainfoin.
- 3 Trailing hose system for slurry spreading.
- 4 Rape-stem weevil.
- 5 Workshop on raw-milk cheeses.
- 6 Microalgae production.
- 7 Dairy cows on pasture.

# The Challenge of Nutrient Losses – Agroscope Supports Agricultural Practitioners

Over the next few years, nitrogen and phosphorus losses from agriculture must be substantially reduced. With a new series of factsheets, Agroscope is helping farmers improve nutrient efficiency and thereby reduce nutrient losses to the maximum extent possible.

**Ernst Spiess, Frank Liebisch**

Phosphorus and nitrogen are lost in different forms into the agricultural system via soil, air and water. There are two adverse consequences to this. Firstly, farmers must supply or buy-in new nutrients. Secondly, these losses are damaging for the environment. Policy-makers have therefore stipulated a reduction path for nutrient losses: over the next few years, nitrogen and phosphorus losses from agriculture must be substantially reduced – a major challenge for the Swiss agricultural sector.

## **Positive development**

Since 1993, Agroscope has on behalf of the Swiss Federal Office for Agriculture compiled a national nutrient balance showing the trend of these losses over several decades. The most up-to-date figures show that since the period 2014/2016 both nitrogen and phosphorus losses have decreased by around 10%. The main reasons for this are lower volumes of imported feed, and in the case of nitrogen, lower mineral fertiliser use. Due to the sometimes-strong annual fluctuations it will be a few years before we see if this is a stable development. In addition, over the past few years, several nutrient flows in Switzerland have been heavily affected by the Coronavirus situation and the war in Ukraine. It can therefore be assumed

that the efforts of all stakeholders will continue to be necessary to achieve the stipulated targets.

## **Knowledge in a nutshell for practitioners**

Agroscope deals with the topic of nutrient flows in numerous projects. With the knowledge gained from these projects, the research institute aims to provide targeted support to farmers, extension and policy-makers to enable the efficient and effective use of nitrogen and phosphorus. To this end, Agroscope is summarising current scientific findings concerning the optimisation of nutrient cycles in new factsheets for practitioners. These factsheets highlight the benefits and drawbacks, trade-offs and economic aspects of individual measures in a nutshell. The system approach that jointly considers both animal husbandry and plant production is key here, since uncoordinated individual measures in one area harbour the risk of losing the improvements achieved there in other areas.

## **From A for agriculture to Z for zootechnics**

The first factsheets show the wide variety of ways to optimise nutrient cycles. Certain measures in the sphere of fertilisation or feed can be implemented more quickly,



Optimised nutrient cycles reduce nitrogen and phosphorus losses from agriculture.

and therefore make a speedier impact. An example of this is the Nmin method for determining the optimal fertilisation requirement. Other measures require more time and money, for example infrastructure modifications such as the conversion of barns. In the coming months, Agroscope will add to the new factsheet series 'Principles for Optimising N and P Cycles' on a regular basis. For ease of reference, the measures will be divided into different subject areas.

### **Working together to develop the agriculture and food sector**

Agroscope will continue to develop new ways to reduce nutrient losses and calculate the effectiveness and implementability of these methods. The Experimental Stations, which have been in operation for three years now, play a key role here. There, researchers test and disseminate the

developed measures together with agricultural practitioners. For example, in the Experimental Stations for Nutrient Flows in Sursee, Vegetable Production in Ins, and Smart Technologies in the Cantons of Thurgau and Schaffhausen, Agroscope conducts intensive research on nutrient cycles. By doing so, researchers, in co-creation with Cantons, farmers, extension and SMUs, are providing important findings for an agriculture and food sector with a promising future. —

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[Factsheet series in German](#)

[Scientific publication:](#)  
[Agroscope Science, 170, 2023, 1-22](#)

# Regional rather than Individual-Farm Targets for Climate-Change Mitigation

Policies for reducing agricultural greenhouse gas emissions are both more effective and more efficient when set at regional rather than individual-farm level. This approach can help us achieve climate targets in a more cost-efficient manner.

**Marta Tarruella, Robert Huber, Gabriele Mack, Nadja El Benni, Robert Finger**

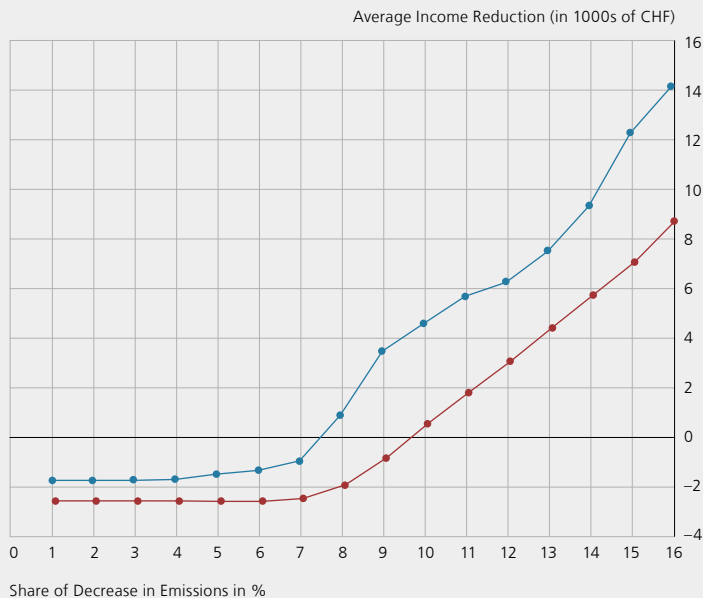
Switzerland and other countries have set ambitious targets for reducing agricultural greenhouse gas (GHG) emissions. To meet these targets, farmers must implement effective and efficient mitigation measures. Often, however, these policies are neither particularly effective (i.e. they fail to achieve their targets) or efficient (taxpayers and farmers find them too costly). Using a bio-economic modelling approach and data from 65 dairy farms in the Canton of Zurich, researchers from ETH Zurich and Agroscope analysed ways in which agricultural emission reduction targets could be formulated more effectively and efficiently.

## Modelling the efficacy of various policies

Experts have analysed two different GHG reduction approaches and how they differ in terms of cost efficiency. The first approach set uniform emission reduction targets for all farms (farm-level targets), so that every farmer had to reduce emissions by the same amount. The second approach set the target at regional level, so that the farms were jointly responsible for achieving the target. This allowed the heterogeneity of the farms to be taken into account, with each farmer making a different contribution to the overall reduction target depending on their

individual opportunity costs. Researchers used a simulation and optimisation approach based on the bio-economic farm model FarmDyn, which was parametrised for a sample of 65 dairy farms to calculate the differences in income reduction for different emission reduction target percentages. The following mitigation measures were





Average income reduction (CHF/farm) resulting from different emission reduction targets and policy development.

**Policy development**  
 ● farm level  
 ● regional level

considered: (1) replacing concentrates with legumes grown on the farm; (2) increasing the number of lactations per dairy cow; (3) slurry spreading using trailing hoses; and (4) introducing feed additives to reduce enteric fermentation in cattle. These measures were chosen since they effectively lowered GHG emissions for each kilogram of milk produced on each farm.

### Increasing cost-effectiveness with regional-level targets

The results of the study show that emission reduction targets at regional level are more cost-efficient than those at individual-farm level. For example, a 10% reduction in GHG emissions per farm would mean an average income reduction of CHF 4654 per farm. If, however, all the farms in a region are jointly responsible for achieving the 10% reduction, the average costs per farm come to just CHF 545, making the regional reduction target 88% more cost-efficient. This is primarily because the marginal abatement costs for some farms are much lower than for others, allowing certain farms to achieve a greater reduction than the stipulated target at lower cost. This allows farms with higher costs to reduce their emissions by a lower amount whilst still contributing to the overall reduction target. —

### Conclusions

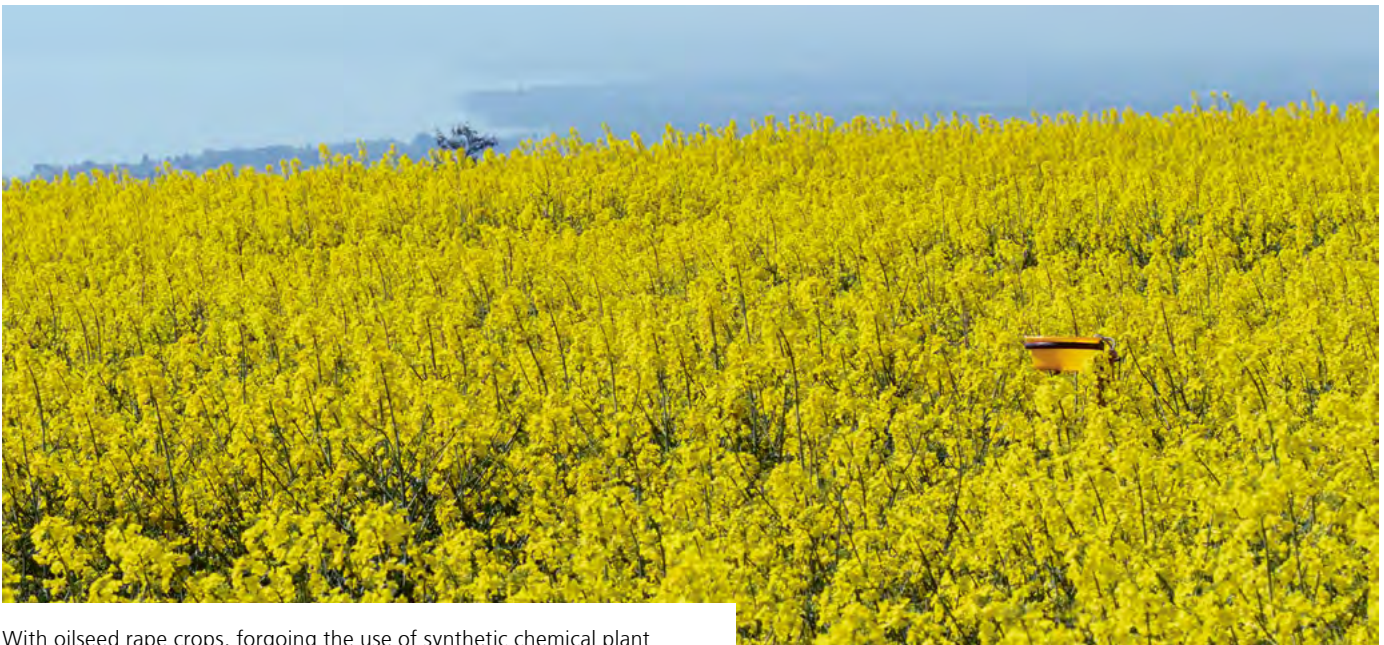
- ▶ The costs of reducing greenhouse gas emissions vary greatly from farm to farm.
- ▶ Setting regional-level reduction targets can enhance the cost-effectiveness of emission-reduction policy measures. The overall abatement costs will then be lower than for individual-farm-level targets.
- ▶ Efficiency gains depend on the combination of mitigation measures chosen by the farm. Instruments and incentives should therefore focus on the volume of avoided emissions rather than on promoting specific measures or technologies.
- ▶ Regional-level targets could also be used to promote stronger social networks and improve communication and the learning process among farmers.

[Scientific publication:](#)  
[Q Open, 2023](#)

# Is a Significant Reduction in Pesticides in Wheat and Oilseed Rape Crops Cost-Efficient?

In wheat crops, pesticides can be used more sparingly without sacrificing profitability. With oilseed rape the situation is more difficult, since the reduced yields are not offset by higher revenues. These are the findings of the analysis of the first two harvest years of the PestiRed project.

**Alexander Zorn, Alain Bütler, Philippe Mathys**



With oilseed rape crops, forgoing the use of synthetic chemical plant protection products led to a significant reduction in profitability.

Swiss arable farms participating in the PestiRed Project are trying to reduce their use of plant protection products, or PPPs. To do this, they focus on the consistent application of integrated plant protection principles. Using data from the first two harvest years of 2020 and 2021, Agroscope researchers examined whether growing wheat and oilseed rape without pesticides can be cost-efficient.

## **Profitability significantly lower for oilseed rape than for wheat**

The findings show that in the current environment, the use of synthetic chemical PPPs in wheat crops can be largely forgone without negatively impacting cost-efficiency. With oilseed rape crops, however, forgoing the use of synthetic chemical PPPs led to a significant reduction in profitability. Thus, after deducting direct



costs and work execution costs, the economic yields of the plots where lower amounts of synthetic chemical PPPs were used were on average 34% lower than those of the control plots.

### **Oilseed rape: reduction in yields not offset by market profits and direct payments**

With wheat, lower yields and higher production costs are offset by higher market premiums and by direct payments from the public sector, with the result that profitability can be maintained, or even improved slightly. With oilseed rape, forgoing the use of PPPs leads to higher yield losses that are not offset by a reduction in costs, higher market performance or direct payments. A starting point might be to further develop the successful linking of direct-payment incentives with market incentives, i. e. to more strongly differentiate the market-side incentives, as with wheat.

### **Seasonality, regionality and farm experience as possible influences**

These initial findings of the cost-efficiency analysis must, however, be interpreted with caution, and cannot be generalised. There are, for example, significant weather-related annual fluctuations, as demonstrated clearly by the 2020 and 2021 harvest years: for both wheat and oilseed rape, yields in warm, dry 2020 were significantly higher than for wetter, cooler 2021. In addition, site-specific environmental factors are not taken into account in the analyses.

Moreover, many of the participating farms already grow wheat, and in particular oilseed rape, with reduced PPP use as standard (even on the control plots), in the

'Extensio' programme. Because of this, they already have experience in forgoing the use of PPPs and have established appropriate work processes. Accordingly, many control plots cannot be interpreted as plots managed according to strictly conventional principles. Ultimately, crop cultivation in the PestiRed project is experimental in nature, with farmers consciously running a certain risk and being compensated by the project in the event of significant crop losses. Thus, the results are not transferable one-to-one to the Swiss agricultural sector.

This analysis is based on the first two years of the project. The analyses from several years of cultivation as well as from the entire rotation after six years' implementation will yield in-depth findings. Moreover, it is to be expected that longer-term observations will increase the reliability of the results. —

### **Conclusions**

- ▶ Largely forgoing the use of synthetic chemical plant-protection products (PPPs) did not on average reduce the cost-efficiency of wheat cultivation for the two years examined. Lower yields and higher production costs were offset by higher market profits and higher direct payments.
- ▶ With oilseed rape crops, forgoing the use of synthetic chemical PPPs reduced the cost-efficiency per plot by an average of 34%. Lower yields and higher production costs were not offset by market performance and direct payments.
- ▶ Effects related to the year and region as well as the non-random selection of the participating farms have not yet been taken into account. The results must therefore be interpreted with caution, and are not one-to-one transferable to the Swiss agricultural sector.

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[PestiRed Project](#)

Scientific publication:  
[Agroscope Science 169, 1–31, 2023](#)

		2022	2023	Divergence	Divergence %
<b>Functional Earnings</b>	CHF	24 830 470	24 091 030	-739 440	-3.0%
<b>Functional Expenditure</b>	CHF	194 368 022	195 128 849	760 827	0.4%
<b>Statement of Investments</b>					
Investment Income	CHF	-45 937	-8 000	37 937	82.6%
Investment Expenditure	CHF	4 182 987	5 516 356	1 333 369	31.9%
<b>Cost Coverage Ratio</b>	%	12.5%	12.0%		-4.0%
<b>Third Party Funds</b>	CHF	16 172 294	18 450 033	2 277 739	14.1%

**1444** publications, including 860 practice-oriented publications; 584 scientific publications

**1615** lectures and posters

**109** supervised dissertations

**107** supervised semester, Bachelor and Master theses

**1972** lessons (universities, technical colleges, vocational schools and courses)

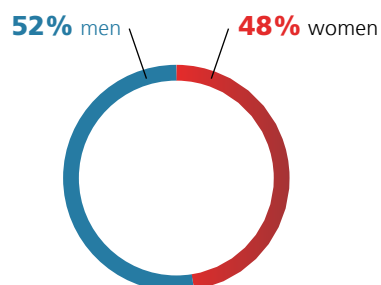
**947** full-time positions (FTE) with **1115** employees

**33** internships

**37** trainees

**62** doctorates

**43** postdocs





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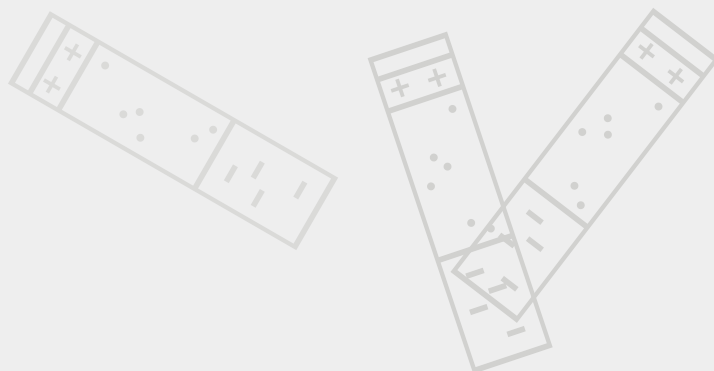
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**‘The aim is to grown the varieties that are best adapted to the site; that way we’ll have disease-resistant varieties providing good yields and a high quality harvest, which is exactly what practitioners want.’**

Kevin Gauthier, Agroscope’s Field-Crop Breeding and Genetic Resources Research Group

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