

FiBL's Eleven Core Missions 2018–2025



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Organic farming, animal welfare and agroecology at the heart of society

In the middle of the 21st century, 500 million farmers will provide sufficient and healthy food for nine billion people. They will do so while using natural resources prudently and without resorting to fossil fuels. Their production will provide them with an economically viable livelihood. Their livestock will utilise the inexhaustible grassland areas and the by-products of the agri-food industry and will not be subjected to distress or suffering.

This is the form of modern organic farming to which FiBL with its numerous research projects, educational activities and consulting knowledge is committed. FiBL is a direct player in several European countries and in numerous collaborations with public and private institutions in practically every country of the world. FiBL's staff want to make a difference. To this end they rely on knowledge gained in the course of hundreds of projects carried out with practitioners and other stakeholders – knowledge which is constantly being expanded through experimental research and thorough analysis. For 45 years now, FiBL staff have been reliable partners to the organic farming sector.

The ecological, economic and social transformation of global food systems is a topical issue and FiBL is doing its part in addressing it, consistently and with determination. To do so, the Institute draws on public funding, grants from foundations, and funding from innovative businesses. With its eleven newly formulated core missions, FiBL consolidates its diverse activities and, in some areas, charts

new territory. Future challenges are to be addressed with the help of forward-looking ideas and methodologies.

The eleven core missions form a document that signals new departures. We would like to significantly increase our impact because we can see how many of our ideas have proven worthwhile and our partners are continuing to fill the pool of solutions. These new departures must also be financed and we are undertaking major efforts to at least double the five FiBL budgets of approximately CHF / EUR 30 million.

Our aim is to place organic farming, animal welfare and agroecology at the heart of the agri-food sector. The time is ripe for transformation. This calls for hearts, heads and hands.

Sincerely,

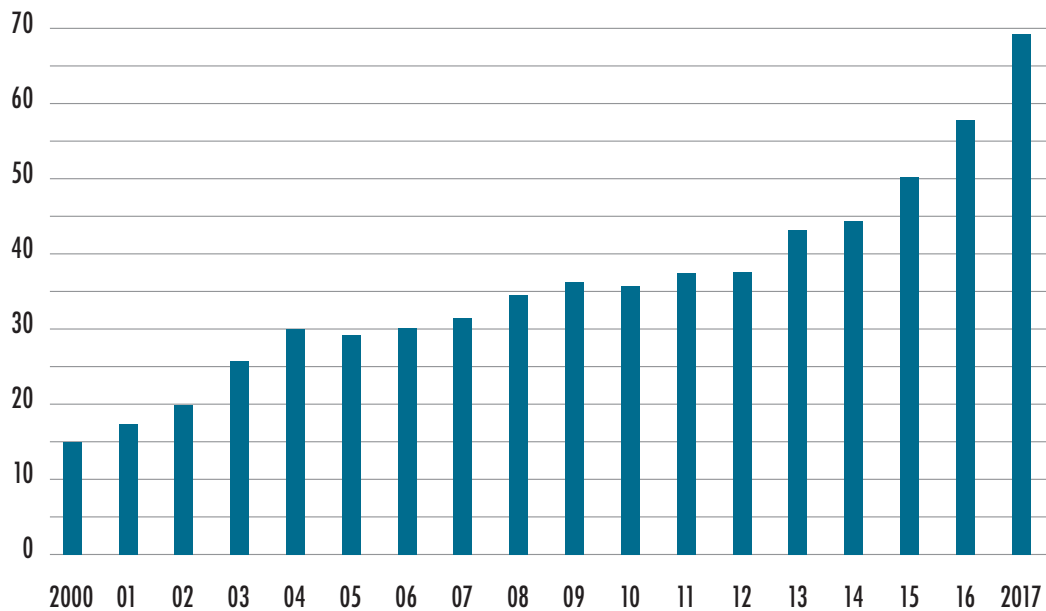


Urs Niggli



Expansion of organic farmland worldwide 2000–2017

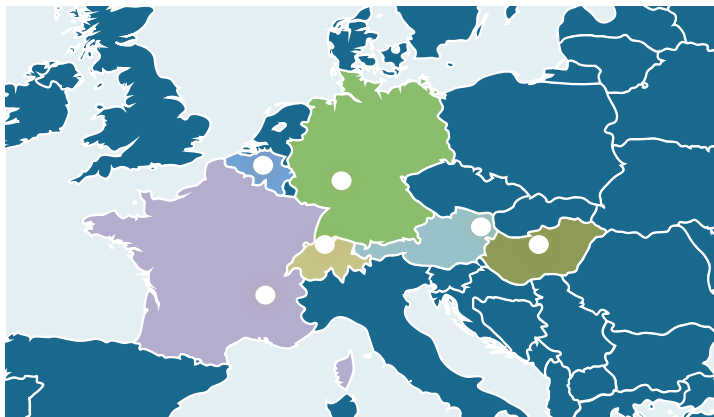
Millions of hectares



The Research Institute of Organic Agriculture FiBL

FiBL is an independent institute engaged in research, education and extension in organic farming. The Institute was established in 1973 as a private charitable foundation in Switzerland. Between 2000 and 2017, additional autonomously operating FiBL institutes were established in Germany, Austria, Hungary, Belgium and France. The close collaboration between 300 experts across national and institutional boundaries has generated exceptional expertise, many economic synergies, and a strong force to drive change in the agricultural sector.

FiBL's mode of operation is committed and professional, placing equal value on fundamental research, joint developments with farmers and the food trade, and dialogue with society at large.



Core mission 1: Plant breeding for agroecological and organic cropping systems

Introduction

Against the backdrop of a growing global population, increasing resource scarcity and adverse growing conditions (climate change), we need innovative and diverse cropping systems to ensure sustainable food security. A broad portfolio of crop species and cultivars is needed in order to meet these challenges. Organic plant breeding ensures the availability of a wide range of crop species and cultivars that are specifically adapted to closed cycles and self-regulating systems as they are found in organic farming, as well as to consumer demands in terms of nutritional quality and taste.

Mission

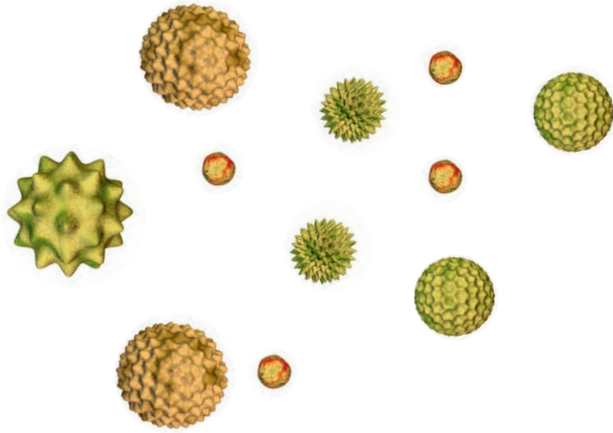
FiBL's breeding research makes a pioneering contribution to the ecological and economic capacity of the sustainable and diverse global organic farming sector. We are guided by the needs of the entire value chain and develop cooperative and participatory strategies based on the latest scientific findings and in accordance with organic farming standards. For all questions concerning organic plant breeding or organic seed at national, EU or global levels, FiBL is a valued and professional contact for breeders, researchers, farmers, agricultural advisers, certifiers, the trade sector and policy-making bodies.

Activities

For 40 years FiBL has been assessing cultivars of numerous crop species under organic cropping regimes. Scien-

tific backstopping of practical breeding programmes has been expanding for the past 15 years. Twenty-five experts work on crop plant breeding at FiBL, i.e. on breeding research, cultivar testing and market introduction. There is close collaboration with organic breeders, breeding researchers and organic associations. It is envisaged that there will in future be increased activity in the following areas:

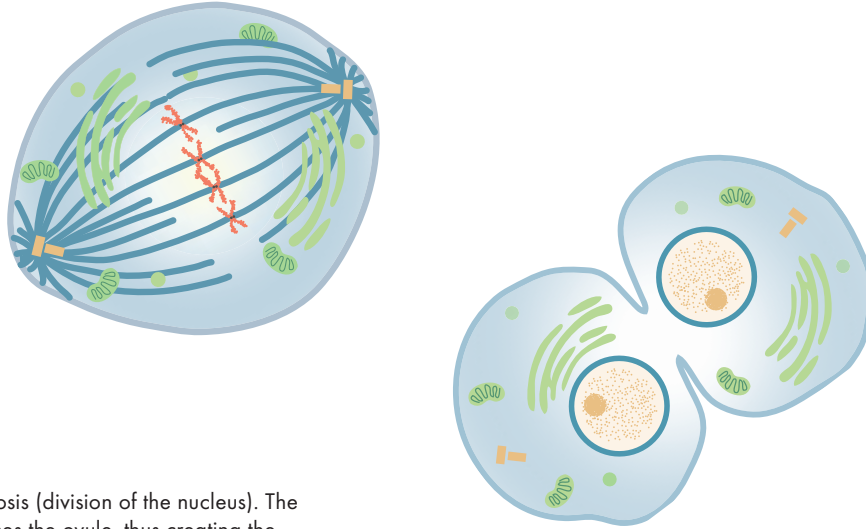
- Innovative breeding projects in Switzerland. FiBL promotes breeding activities for field crops, vegetables and fruit by means of research and extension. There is a focus on legumes as important protein sources. For example, FiBL breeds white lupins that are resistant to Fusarium wilt, and peas that are suited for mixed cropping and that can deal better with environmental stresses by entering into symbioses with soil microorganisms. A further example is the development of soybeans with improved weed tolerance and suitability for processing into tofu.
- Participatory breeding programmes in the global South. Together with farmers, breeders and the entire value chain, FiBL also initiates participatory breeding programmes in countries of the global South in order to increase smallholder families' seed sovereignty. The current focus is on GM-free cotton breeding in India. These activities are to be extended to other countries and also to other crop species.



Macro photographs of pollen grains of different plant species. Pollen cells are haploid as a result of reductional division (meiosis), i.e. they contain only a single set of chromosomes.



Improving white lupin disease tolerance (Christine Arncken, plant breeder).



Two phases of mitosis (division of the nucleus). The pollen grain fertilises the ovule, thus creating the zygote. Cell division follows this targeted crossing.

- Organic cultivar testing, organic seed and market introduction. FiBL carries out cultivar testing under organic conditions. A second focus is on increased vitality and health of organic seed and vegetative propagating material. In order to improve seed availability, FiBL has set up the OrganicXseeds database for organic seed and will expand this to form an EU-wide standard. With a view to the further strengthening of organic breeding, FiBL is assessing a number of different funding models and marketing strategies and is pressing for an optimal regulatory environment for organic breeding and variety approval.

Methods

In interdisciplinary consortia, FiBL investigates the physiological and genetic fundamentals of crop plants; it also studies selection methods and strategies for breeding crop plants with increased tolerance of diseases,

pests and weeds, increased resource efficiency (nitrogen, phosphorus) and adaptability to physical stresses (heat, frost, salination, drought, flooding, ozone). The aim is to adapt the plant to the environmental conditions that prevail in organic farming and to increase the cropping system's resilience by broadening the genetic diversity and improving the interaction between the plant and both neighbouring plants and the microbial communities in the living soil. Nutritional and sensory criteria are also taken into account. To this end, FiBL develops screening tests, generates crosses and conducts extensive field trials both on organic farms and under controlled conditions. In order to identify mechanisms of inheritance, the plants, pathogens and microbial associations are phenotyped and genotyped, root exudates and metabolites are analysed under different stress conditions and rapid tests are developed for diagnostic purposes and for marker-assisted selection. In the medium

term, we aim to optimise selection by means of spectral instrumentation.

Partners

Private organic breeders in a number of different countries, additional public and private breeders and breeding researchers worldwide. Universities and public research institutions active in breeding and cultivar development. National and international sector organisations and representatives of producers. Joint projects and activities are carried out with more than 50 institutions.

Our goals for 2025

FiBL can demonstrate major successes in crop breeding research into suitability for mixed cropping and into improved symbioses with soil microbes. FiBL is the global leader in organic cotton breeding. The establishment of participatory breeding initiatives in Africa is resulting in increased seed sovereignty. FiBL makes improved breeding material, such as Fusarium wilt-tolerant white lupins, available to interested breeders and farmers. The organic cultivars that have been developed stand out for their productivity and adaptability. FiBL has integrated the latest phenotyping and genotyping methods into its research projects and developed new screening methods and a comprehensive training concept. FiBL is supported by a reliable international network and cooperates closely with practitioners engaged in crop breeding for organic farming.

Summary

FiBL is the leading centre of excellence and innovation in organic crop plant breeding. Its aim is to develop a broad portfolio of productive, resilient and site-adapted cultivars for innovative, diverse and sustainable organic cropping systems. FiBL's breeding research incorporates all aspects of professional support for organic breeders, from

the development of innovative breeding strategies and screening tools to improved breeding material, cultivar testing, seed health, organic seed databases, training and staff development, networking and capacity building for players and also including the market introduction of new cultivars and the development of funding strategies and business models for sustainable plant breeding, cultivar testing and seed production.

Funding

Funding for FiBL's work comes from projects and contracts commissioned by the EU, Switzerland and other countries, charitable foundations and businesses engaged in organic trade. Organic breeding and cultivar development is a niche activity in Europe and a marginal one at the global level. FiBL wants to change this and, in the medium term, is working towards an additional funding volume of CHF / EUR 5 million per year.

Contacts

Monika Messmer, Pierre Hohmann, Andreas Kranzler, Christine Arncken and Freya Schäfer

Core mission 2: Use of digital technology in modern organic farming

Introduction

Digitalisation is opening up new possibilities in crop production, animal husbandry, farm management and knowledge transfer. How can organic farming profit from these developments? What advances is digitalisation bringing to agricultural practice?

Mission

FiBL becomes the leading institution in “digital farming” in the organic sector. It tests the most advanced digital technologies available and develops innovative methods and techniques that make small-scale organic agriculture more eco-friendly and efficient overall. In cooperation with the developers, the digital technologies are adapted to the needs of organic farming and organic animal husbandry and – provided that they pass the tests – introduced into farming practice. To this end, FiBL collaborates on an international level with the leading institutions in the field of digitalisation. Optimisation of the organic farming system and a greater contribution to the common good are the goals. FiBL analyses the impacts of digitalisation on stakeholders’ quality of life, the sustainability of the processes involved, animal welfare and product quality, and develops purposeful solutions for organic farming.

Activities

FiBL has been actively involved in the development of mechanical and physical crop protection methods for 40 years. Optimisation of livestock wellbeing and health has

been a priority for 20 years. FiBL and its scientists and consultants want to identify the potential and risks of digitalisation for organic farming and put this potential to appropriate use. To this end, the following activities will be expanded or launched:

- More efficient weed control with automatic steering systems. Weed control is the biggest cost factor in organic arable cropping and horticulture. Although there are numerous options for controlling weeds between rows, controlling weeds within rows still takes up to 200 working hours per hectare in certain crops. With new GPS-steered cultivators, it is possible to get closer to the crop rows, and the devices are more precise and faster. Cultivation within rows is extremely demanding. At FiBL, experiments with cycloid hoeing are being conducted in sugarbeet crops. (Semi-)autonomous robots that can distinguish weeds from crop plants and remove the identified weeds with a knife are also being tested.
- Improved field diagnostics. If initial symptoms are detected promptly, diseases can be delayed for days or even weeks, and primary outbreaks (in potatoes, for example) can be eliminated by mechanical means. Drones equipped with high-resolution cameras that provide relevant information can be used for monitoring. Root-spreading and rhizomatous weeds can also be detected and quantified with the aid of drones. Depend-

ing upon the density and spread of the detected weed hotspots, the soil can be worked more intensively or extensively. Analysis of aerial images also shows whether the growing conditions are ideal for a crop. Fertilisation and irrigation can then be appropriately adapted at an early stage.

- Precision seeding to enhance biodiversity. Precision seeding technologies make it possible to subdivide larger fields into smaller units without economic sacrifices. With the aid of GPS, flowering strips can be integrated into existing fields or established before the main crop is sown, in exactly the required positions. Areas for the enhancement of biodiversity can thus be more effectively interconnected.
- Permanent tractor tramlines for less soil compaction and erosion. Soil compaction due to heavy traffic adversely impacts soil functions such as water storage,

drainage and filtration, ultimately leading to reduced yields. Soil compaction is greatly reduced with a management system known as “Controlled Traffic Farming (CTF)”, which limits all machine loads to permanent tramlines that occupy the minimum area necessary. The system could have major advantages over the medium term, especially if it were combined with no-till and anti-erosion measures, for example with strips that are permanently grassed down.

- Sensors for early detection of diseases in livestock housing. Being able to identify animals individually offers many opportunities for observation and diagnosis and enables targeted feeding and adapted management. With the combination of behaviour, metabolism and position data collected by sensors and measuring stations (in the milking parlour, for instance), FiBL aims to develop modern and precise pasture management and feeding systems.



Grazing activity, movement intensity and wellbeing are recorded using sensors, thus providing farmers with a “log book” for each cow.



Thanks to high-resolution cameras, the state of health and vigour of crops (in this case wheat) can now be assessed by means of hyper-spectral analysis.

- Dialogue with the industry. In order to shape and utilise digital technologies efficiently and purposefully for actual practice in organic farming, FiBL is bringing the relevant stakeholders to the table: developers, users, researchers, practitioners, entrepreneurs and legislators can thus discuss what they require from the technology and develop new approaches together. A common code of conduct that will ensure that the technological developments are adapted to the farmers' needs is being drawn up. The code must also cover ethical principles with respect to the development, application and processing of data – an important issue here is the question of who the data belong to.

Methods

FiBL is testing and combining as many digital tools for organic crop production and animal husbandry as possible. These are primarily instruments for the early detection of diseases and epidemics using drones, spectral cameras, sensors and autonomous robots. Early detection makes it possible to take appropriate action and reduce the use of sprays and pharmaceuticals to an absolute minimum. Successful developments are disseminated via pilot farms. Robot prototypes will be adapted to the needs of organic farming by FiBL in collaboration with the developers. The emphasis here is on a systems approach.

Partners

Collaboration with large agricultural equipment companies and innovative start-ups. Technical colleges, universities and research institutes. There are projects and activities with 20 institutions. Future transparency in access to collected data and in data processing are key criteria for the selection of partners.

Our goals for 2025

FiBL has incorporated the latest digital technologies in diagnosis, monitoring and robotics into ongoing projects; the technologies are being used daily. Diseases, pests and weeds can be detected earlier and consequently treated in a more targeted and efficient manner. Diseases and pests are detected by drones equipped with high-resolution spectral cameras. Weeds are identified by autonomous

robots and efficiently eliminated by laser, electricity or machine in an environmentally-friendly manner while still at the cotyledon stage. Before they are integrated into practice, the technologies undergo ongoing improvement and testing by FiBL in collaborative projects with third-party companies and technical colleges. Modern, digital-based grazing systems have been developed, feeding is becoming more efficient and the impacts on animal health are quantifiable. Thanks to these new technologies, organic farming is becoming “greener” and more efficient in both crop production and animal husbandry.

Summary

Sensors, satellite-controlled devices, cameras and simple robots are being used ever more frequently in agriculture. For example, milking robots are becoming increasingly common. The trend is in two directions: on the one hand, more and more sensors, drones and cameras are being used to monitor plant populations and animal herds, and on the other hand machines are becoming more autonomous to the point of becoming robots that perform the manual labour. FiBL is testing digital technologies and methods for application in modern organic farming in the barn and in the field and is refining them in cooperation with leading partners. Farm managers can be better and more quickly prepared for future technologies. These developments will have a decisive influence on the day-to-day work of farm managers and will have impacts on the entire agricultural system, including both the upstream and downstream sectors.

Funding

A new research focus with emphasis on agricultural practice, “digitalisation”, is being established on the basis of the FiBL team’s experience in production engineering. This requires major efforts in terms of funding so as to do justice to the specific concerns of organic farming. FiBL is investing approx. CHF / EUR 3 million per year, of which only a small portion has been secured so far.

Contacts

Hansueli Dierauer, Hans-Jakob Schärer, Andreas Surböck, Florian Leiber and Christian Lambertz

Core mission 3: Organic crop protection for the entire farming sector

Introduction

Diseases and pests, and invasive species in particular, cause major losses in agriculture. Preventive measures and direct crop protection can avert these losses. Preventive measures include diverse cropping systems, functional agrobiodiversity, multi-crop rotations and resilient or resistant cultivars. They also include modern diagnostic methods for the early detection of harmful organisms, based on molecular biological analyses, sensors or high-resolution cameras. Measures for the direct control of pests and diseases are indispensable in organic farming and may involve products of biological, physical or mineral origin.

Mission

FiBL finds holistic solutions for stable cropping systems that are exemplary in ecological terms and economically viable. FiBL develops innovative means, methods and strategies for pest and disease control in fruit production, viticulture, horticulture and arable farming. Copper and other products of concern (such as paraffin oil and spinosad) are being replaced by third-party products and by FiBL's own technologies (Larixyne® and innovative flowering strips, for example). Through the www.inputs.eu network, FiBL promotes the harmonisation of input lists in Europe and represents the concerns of the organic farming sector. The organic farming sector has at its disposal a comprehensive range of effective crop protection products that are ecologically compatible and pose no danger in

terms of human toxicology. The potential for the consistent utilisation of biodiversity in agriculture is being even more rigorously exploited. The integration of functional agro-biodiversity for the purposes of pest reduction, pollination and enhanced soil fertility is ensured. As a result of the consistent use of modern digital technology, preventive agronomic measures are becoming economically viable as well as scalable. The aim of this integrated systems approach is to improve the sustainability of organic cropping systems. It also contributes to the optimisation of non-organic production systems (reduced usage of auxiliary inputs etc.).

Activities

Crop health has been a focal topic for FiBL since its inception 45 years ago and the Institute has impacted greatly on the techniques used today. The development and introduction into agricultural practice of crop protection methods has been at the core of FiBL's work. The inputs list benefits farming associations, certifiers and farmers. FiBL organises an annual conference for companies and organisations working in the area of organic crop protection (www.abim.ch). Thirty experts work on this topic at FiBL and the Institute is planning to significantly expand these activities:

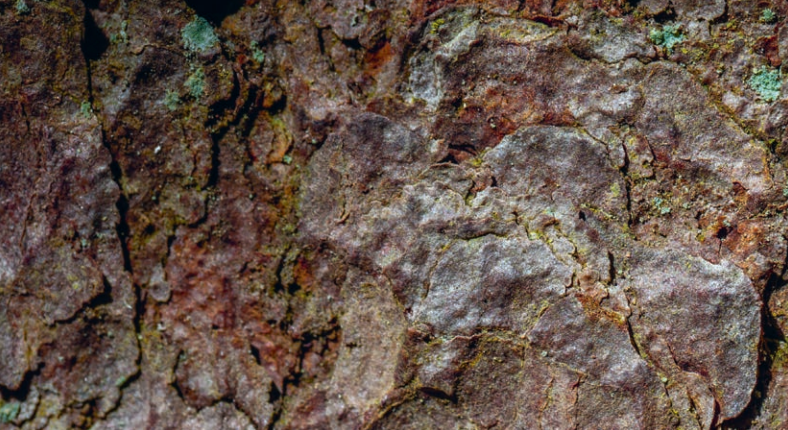
- Direct crop protection and substitution of controversial products. FiBL researches and develops new crop treatment products and practice-oriented decision-making

aids for crop protection. To this end, FiBL optimises existing and new products (organic crop protection products, naturally occurring substances, repellent fragrances and resistance-inducing substances) and physical methods.

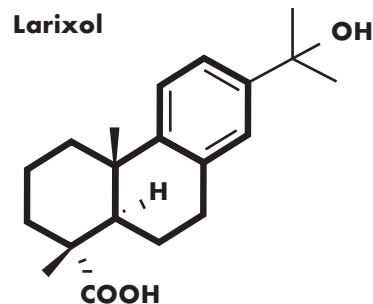
- Research on specific plant pathogens and pests. FiBL intensifies its research into invasive pests (such as spotted wing drosophila and brown marmorated stink bugs) and pathogens (in particular Marssonina leaf blotch, a new disease in apples). The control of insect-transmitted plant diseases, such as pear decline and citrus greening, will be a further focal topic. In the course of our work we will enhance understanding of the biology and epidemiology of such diseases and work on diagnostic and detection methods.
- Inputs list and technology assessments. The FiBL list of permitted fertilisers, plant protection products, disinfection agents, antiparasitic drugs and feed-stuffs has been in existence since 1992. Through our www.organicinputs.org and www.inputs.eu network we promote the harmonisation of input assessments and input lists in Europe and represent the concerns of the organic farming sector.
- New techniques and technologies. The availability of new techniques and technologies is crucial for the further development of production techniques and crop protection. They include plant protection products based on newly discovered natural substances, biocontrol organisms, nanotechnology, new breeding methods and innovative machinery (robots for example; see core mission 2). FiBL assesses the suitability of these technologies for organic agriculture.
- Functional biodiversity. The consistent promotion of ecosystem services by means of habitat management



Organic crop protection is a focus of our work. Organic agriculture has enormous potential on arable land and grassland to reduce agricultural pesticide use. However, there is a major development need with regard to new methods in fruit production, viticulture and horticulture.



Using special extraction methods, FiBL extracted an active ingredient from the bark of the European larch (*Larix decidua*) which can be used to control a number of different mildew fungi. Following comprehensive testing, the active substance larixol (see structural formula) will be submitted to the registration authorities for authorisation as a fully natural fungicide. Something that seems very simple is the outcome of a very expensive research and registration process.



and cultivation measures is particularly important as a means of keeping populations of harmful organisms at low levels. In this regard it is crucial to develop a better understanding of the complex spatial and temporal interactions between hosts, pests and beneficials in semi-natural habitats and cropland as well as at other scales. The installation of ecologically customised flowering strips as effective semi-natural elements has proven a promising measure. This kind of optimisation can improve natural pest control and help reduce pesticide usage.

- Risks and opportunities of climate change for plant protection. We identify the impacts of climate change on native and introduced harmful organisms and on the cropping system as a whole. In addition, we evaluate and communicate plant protection measures for optimal adaptation of organic agriculture to climate change (see core mission 11). A further focus is on the landscape-scale control of highly mobile pests such as spotted wing drosophila and the common pollen beetle. We conduct research into interactions between cultivation techniques and pest infestation with a view to developing adaptable systems.

Methods

FiBL works with universities and companies specialising in natural substances in order to combine expertise in natural products chemistry, commercial production and market approval. The Institute is also involved in additional research alliances as part of European consortia and in regional and local projects. FiBL develops and tests new products and methods in the laboratory, in field trials (recognised Good Experimental Practice) and in collaboration with producers on commercial farms. We are furthering the implementation of functional agro-biodiversity in annual and perennial crops in on-farm trial networks. We are working to improve natural pest control in a range of model crops such as apple, cherry and cabbage by promoting agro-biodiversity through the use of flowering strips, companion plants and well-structured habitats in the vicinity of crops.

Partners

Small and medium enterprises, public and private research institutes, universities, farmers, research networks and public authorities. There are projects and activities with more than 50 institutions.

Our goals for 2025

For significant annual and perennial crops, FiBL integrates cultivation techniques, cultivar choices and plant protection into optimal systems, thus improving ecosystem services such as climate resilience (ability to adapt to changes in the climate), pollination, natural regulation of harmful organisms and soil fertility. Organic breeders can make use of new disease-resistant and pest-resilient cultivars for their cultivar development. Copper has been replaced or is used in significantly smaller quantities in organic agriculture. We are working on both “silver bullet solutions” (practical, ecologically exemplary solutions for individual problems) and “system redesign” (resilient and self-regulating production systems). Technological and agro-ecological innovations are to be discussed at length with stakeholder groups and decision-makers. Preventive and direct measures in conformity with the organic regulations are to be used to control new invasive pest species that are a side effect of climate change and of the greater mobility of goods and people.

Summary

FiBL develops innovative biological plant protection measures for arable farming and special crops. These include preventive strategies such as optimised cropping systems and crop rotations, promotion of functional agrobiodiversity, modern methods of diagnosis and direct measures such as the substance Larixyne®. For and with our partners we harmonise the input lists at the European level,

and each year we organise the Annual Biocontrol Industry Meeting (ABIM), the world’s largest sector conference on biological pest control. We want to expand these and other activities relating to plant treatment substances, plant pathogens and pests, technology impact assessments, new technologies, functional biodiversity and climate change so that by 2025 we have developed optimum cropping systems, replaced copper or achieved a significant further reduction in its use, and developed practical solutions – including methods of controlling new invasive pest species – to the problems faced by organic farming,

Funding

The funding to date from work commissioned by the Swiss, Austrian and German governments, from a number of EU projects and from charitable foundations and innovative businesses is resulting in continuous improvements in agricultural crop yield security, the environment and food quality. However, research funding is divided very unequally between organic farming and farming in general, especially when it comes to crop protection. FiBL will therefore strive to address this imbalance. Investments of CHF / EUR 5 to 10 million per year will be needed for far-reaching impact.

Contacts

Lucius Tamm, Claudia Daniel, Lukas Pfiffner, Bernhard Speiser, Marlene Ariana Milan and Richard Petrasek



Can optimised organic agriculture resolve the conflict between the objectives of productivity and environmental protection? That's what Else Bünemann and Norah Efosa are trying to find out. Here they are seen sampling soil-borne greenhouse gases in closed static chambers and taking soil samples in order to determine chemical, biological and physical soil properties.

Core mission 4: Optimum nitrogen management for crops, livestock and the environment

Introduction

Nitrogen tends to be the most important yield-limiting factor in organic farming and must continuously be provided through humus, organic fertilisers and green manure (primarily legumes). At the same time, nitrogen is easily lost to the environment through leaching or in the form of gaseous losses where it damages natural ecosystems, pollutes watercourses, and contributes to global warming. Optimum nitrogen management is therefore a key to environmentally-friendly and productive organic agriculture.

Mission

FiBL establishes a position as a centre of excellence for prudent nitrogen management in a variety of growing regions and climates. It utilises molecular-biological methods and stable isotopes in order to study and optimise biological processes. It measures and models material flows and uses planning tools to optimise these flows. By establishing close linkages between livestock production and crop production, on-farm losses and imports of nitrogen are minimised without adversely impacting on agricultural production in terms of yields and quality. Nitrogen from societal materials cycles is put to use in the farming sector in the form of composts, digestates and alternative feed-stuffs; biological nitrogen fixation by legumes is improved.

Activities

Good nutrient supply in organic agriculture is an issue FiBL has been working on since its inception. This issue

also prompted the commencement of the DOK trial in 1977 in north-western Switzerland, a trial that has become a global benchmark for the productivity and ecological excellence of organic agriculture. These activities are to be greatly expanded by means of:

- Optimised nitrogen management. FiBL is optimising nitrogen management at all scales (crop, crop rotation, farm, landscape). The potential of legumes as suppliers of nitrogen for organic agriculture is increasingly being used as a result of work conducted in the area of microbe-plant interactions and due to plant breeding and improved crop rotations and cropping systems. On-farm strategies are being developed for reducing nitrogen losses in livestock production and in the course of utilising livestock farm waste, composts and digestates.
- Adapted cultivars and alternative crops. FiBL is conducting research on cultivars and crops which contribute to improved nitrogen utilisation, including under conditions of increasing drought stress in temperate and tropical climates.
- Fertiliser planning. FiBL is developing aids for fertiliser planning which take into consideration the site-specific soil nitrogen delivery, plant nutrition (for high-quality products) and short-term as well as medium-term impacts of organic fertilisers. At the regional level, nu-

trient flows between society at large and the farming sector are being optimised.

- Livestock feed. Feedstuffs based on recycled nutrients and food waste help to close nitrogen cycles.
- Modelling. Regional, national and global models are contributing to improving the food system and adapting consumer behaviour to the carrying capacity of planetary ecosystems.

Methods

In the areas of plant breeding, symbioses, fertiliser use and greenhouse gases FiBL has already worked intensively on nitrogen in the past. Various aspects of the nitrogen cycle are the focus of current projects. Stable isotopes are used to investigate the short-term and medium-term utilisation of nitrogen contained in organic fertilisers while accompanying research documents all nitrogen loss pathways in the field. The abundance and diversity of nitrogen-transforming soil bacteria is being investigated using the latest molecular-biological methods, with a view to gaining an improved understanding of microbial nitrogen transformation and optimising these processes. In the area of symbioses, similar approaches are key to improving biological nitrogen fixation. Future projects primarily aim at optimising on-farm nitrogen efficiency and at strengthening regional approaches to improved nitrogen management. Substance flow analyses and nutrient input/output accounting are used to this end as well as, in particular, spectroscopic methods for the characterisation of organic fertilisers. Remote sensing methods are also employed to this end (see core mission 2).

Partners

FiBL cooperates very closely with public research institutes and universities. There are also individual projects being conducted in collaboration with Indian scientific partners. Moreover, FiBL collaborates closely with farmers, the industry and environmental authorities. Overall, FiBL collaborates on this topic with more than 30 institutions.

Our goals for 2025

FiBL sustainably improves nitrogen supply in organic agriculture and reduce nitrogen losses. The Institute is an important and well recognised research partner in the areas of microbiology, plant breeding, livestock farm waste, composts and digestates, cropping systems, animal husbandry and life-cycle assessment. With its systems approach, which builds on process studies and upscaling, FiBL generates important momentum for reducing the farming sector's nitrogen footprint. FiBL produces and makes available information leaflets and digital aids for farm level and regional level implementation.

Summary

Nitrogen tends to be the most important yield-limiting factor in organic farming. Green manure, humus management and the maximum closure of substance cycles between the farming sector and society at large by means of utilising livestock farm waste, composts, digestates and alternative feedstuffs are therefore key. At the same time, nitrogen losses to the atmosphere and to watercourses must be minimised. FiBL is developing strategies and aids designed to improve nitrogen utilisation efficiency in agriculture and in the global food system.

Organic agriculture utilises legumes as main crops, catch crops and cover crops.

Root nodule symbioses with rhizobial bacteria enable these plants to obtain nitrogen that the bacteria fixed from the atmosphere. In exchange, the plants supply energy to the bacteria.



To this end, FiBL is researching biological processes, systems approaches and models. Greater efficiency and sufficiency will reduce the farming sector's nitrogen footprint.

Funding

Yield security and environmental compatibility are both significantly influenced by fertiliser use and are often at odds. Therefore, a number of different funding bodies such as the governments of Switzerland, Austria, Lower Franconia, the canton of Solothurn and the EU are drawing on the problem-solving competence of the organic farming sector. FiBL aims to increase funding for work in this field by CHF / EUR 2 million per year.

Contacts

Else Bünemann, Andreas Fliessbach, Paul Mäder, Robert Hermanowski and Andreas Surböck

Core mission 5: Animal welfare, productivity and sustainability – solving the conflicts

Introduction

Trying to foster animal health and welfare at the same time as environmental sustainability and global food justice and within the same agricultural production system would appear to be like trying to fit the proverbial square peg into the round hole. Our research must be judged by the extent to which it meets the key challenge of modern organic livestock husbandry, i.e. to reconcile animal welfare with efficiency while simultaneously centring one's thinking and acting on both the system and the animal.

Mission

With new strategies for the rearing and feeding of youngstock of cattle, pigs, poultry and fish, FiBL strives to significantly improve animal welfare and health as well as resource efficiency. With its work on plants, rich in active ingredients, and their use in veterinary medicine, parasitology and livestock nutrition, FiBL links animal welfare and livestock nutrition approaches that pose the least possible competition to human nutrition with botanical and biochemical diversity. A diversity of suitable genotypes of ungulates and poultry are of major importance for such systems, which is why FiBL strives to develop and enhance such diversity.

Activities

FiBL's initial work on ethologically sound livestock systems goes back to the 1970s. The Institute has been working on

a holistic animal health management system for the past 20 years. More than 250 commercial farms constitute the FiBL research and development network. A total of more than 40 scientists and technicians at FiBL are working on this issue. FiBL aims to strengthen these activities in the following areas:

- Plant-based bioactive compounds. The diversity of plant-based bioactive compounds such as tannins or essential oils has a significant impact on animal health, animal nutrition, ethologically sound husbandry and product quality. FiBL considers research into the veterinary and nutritional significance of these substances to be a methodological key to holistic, sustainable and precisely operated organic livestock husbandry.
- Dual-purpose breeds. In the poultry sector, FiBL will address the growing demand for dual-purpose breeds (for eggs and meat) by systematically evaluating genotypes in its new research poultry house. Approaches to grassland-based low-input cattle systems similarly focus on dual-purpose breeds.
- Youngstock management. Youngstock are the long neglected foundation of animal husbandry, which is why in recent years FiBL has made youngstock management a priority. We are systematically addressing the topics of health, welfare and nutrition for calves, lambs, piglets, chicks and young fish.



Veterinarian Julia Rell takes blood from a cow for her dissertation which focuses on the health of young cattle. If they are robust they will be healthy dairy cows who need less antibiotics.



FiBL is developing for commercial use a natural method of deworming livestock. Here the *Duddingtonia flagrans* fungus can be seen devouring a gastrointestinal worm larva.

Methods

FiBL is modernising and expanding its experimental and diagnostic facilities for ungulates, poultry and fish in order to collect behavioural and physiological data with great precision. In addition to the new trial livestock housing, these facilities include a pasture laboratory to be newly established. The latter will allow for comparisons at high spatial and temporal resolution of the selection of plants by ruminants and their health, productivity, efficiency, and product quality. FiBL will thus combine veterinary medicine, livestock nutrition and behavioural research. The pasture laboratory will also be designed to foster advances in organic parasite control. By combining precision trials in veterinary medicine, parasitology and livestock nutrition on its own experimental farm with on-farm research on its partner farms, FiBL ensures experimental precision and practical applicability in equal measure. In cooperation with breeding associations, for

example in a new breeding programme for organic male beef cattle, FiBL will professionalise the utilisation of large quantities of data for the purposes of veterinary herd or flock management and for the analysis of long-term developments in livestock breeding.

Partners

Our most important partners are the farm holdings involved in our on-farm research. However, our partners in a great number of different projects also include numerous scientific institutions (universities, technical colleges, public research facilities and scientific societies), partners in the industry (sector associations, breeding associations, manufacturers of feedstuffs and remedies, abattoirs, dairies, processors, retailers) both in Switzerland and abroad. Other important partners include the agricultural and veterinary associations, public authorities and educational institutions.

Our goals for 2025

FiBL makes significant progress in the areas of youngstock rearing, feeding and health (cattle, pigs, chickens and fish). Feeding systems are developed which utilise diversity in order to enhance animal health and welfare and which improve the sustainability of fodder production by means of improved nutrient utilisation. For cattle and poultry, FiBL targets breeding efforts more specifically to the conditions prevailing in organic farming (dual-purpose breeds and / or robust lines for site-adapted low-input feeding regimes). This work gives rise to organic poultry lines and organic male beef cattle from dairy lines. In addition, FiBL engages in product development (phytotherapy and organic parasite control) with a view to minimising the use of antibiotics and anthelmintics (“wormers”) in livestock husbandry.

Summary

FiBL is setting itself the task of laying out, in unembellished terms, the still existing environmental, health and welfare related challenges in organic livestock husbandry, and of solving these challenges using holistic approaches which do not address the different areas separately but systemically. In particular, this includes the healthy and sustainable rearing of youngstock, reductions in imported arable crops for feeding purposes, efficient use of nutrient resources, and the minimisation of antibiotics and anthelmintics as well as of some significant shortcomings in animal welfare. The experimental capacities at Frick and the

on-farm research approach on commercial livestock farms will be expanded significantly in order to come up with holistic solutions more swiftly.

Funding

Activities are funded through projects and commissions by the governments of Switzerland and Austria, by a number of different EU projects, by companies with an interest in alternative remedies, and by charitable foundations. Given the significant backlog in matters of the environment and animal welfare, FiBL aims at investing an additional CHF / EUR 6 million in this area, provided such funding can be obtained.

Contacts

Florian Leiber, Anet Spengler Neff, Michael Walkenhorst, Christian Lambertz and Reinhard Geßl

Core mission 6: Climate change and organic farming

Introduction

The hot and dry year of 2018 gave us another taste of future climate trends. The latest scenarios project that it will continue to get drier and hotter, that it will snow less, and that weather extremes will occur more frequently. These climate change impacts also pose a threat to agricultural production and consequently to food security. Organic agriculture is facing major pressures due to climate change. Agriculture itself contributes actively to climate change via direct and indirect greenhouse gas emissions (approx. 15% of the total emissions).

Agriculture is thus faced with challenges on two fronts: On one hand, it must reduce climate change through suitable measures (mitigation), and on the other hand it has to adapt to the impacts of climate change (adaptation). This means that production systems with which good and stable yields are achievable, even under the impacts of climate change, have to be developed and promoted. Furthermore, an institutional context (e.g. information transfer, insurance solutions) has to be created that permits us to cope with the impacts of climate change in the best possible manner.

Mission

For organic farming, FiBL is a key institution for research on the influence of agriculture on climate change, for providing information for agriculture, and for developing precautionary and sustainable adaptation options. We define standards for measuring and assess-

ing emissions, mitigation and compensation actions, and adapted measures in the areas of fertiliser use, cultivation techniques, cultivar selection and plant protection. We develop, manage and implement projects on local, national and international levels using state of the art technologies. In these projects, we take the individual field or farm as well as the entire food system into account. FiBL activities thus range from all areas of basic scientific research, applied research and extension in the field to national and international practical and policy advice.

Activities

- Reduction of greenhouse gases on organic farms. FiBL is investigating to what extent and with which measures organic farms can contribute to reducing greenhouse gas emissions and increasing carbon sequestration in the soil. What is meant by this is the storage of CO₂ in humus. These scientific and agronomic studies are accompanied by analyses, the aim of which is to identify and evaluate suitable policy instruments for promoting mitigation measures in agriculture, especially in organic farming.
- Measures for adapting to climate change on organic farms. FiBL is identifying and evaluating measures that will enable organic farms to adapt to climate change in an optimum manner. FiBL is also bringing synergies

and goal conflicts with other fields to light and showcasing options for action in biological pest control. Data on the past, present and future climate are used to predict the impacts of such measures and actions on the water regime and nutrient cycle and on organisms harmful to crops. FiBL is also part of the international network for monitoring invasive pests and developing seasonal decision support systems for their control.

- Communication on climate change and organic farming. FiBL lays the foundation for decisions that take climate change into account and is strengthening knowledge transfer in this thematic field for extension, education and training. FiBL also publishes scientific publications on climate change and organic farming on a regular basis. These publications summarise the most up-to-date knowledge.

Methods

State-of-the-art field and laboratory analytics (spectroscopy, remote sensing); application of current climate scenarios; highly resolved spatial and temporal climate impact models; statistical data and meta analyses; cross-thematic risk analyses and decision support systems. FiBL is studying the microbiological processes of the carbon and nitrogen cycles that contribute to the reduction of greenhouse gases. To gain a better understanding of the processes, FiBL is working at various scales: molecular biology studies provide information



Earthworms are the best climate protectors. They convert organic crop residues to stable humus.

on the numbers and genetic diversity of soil bacteria, which are responsible for the generation and breakdown of greenhouse gases in the soil. Long-term studies (DOK trial, tillage studies) model actual farming systems and serve as experimental platforms. FiBL is conducting field studies on soil fertilisation with recycled organic fertilisers and mixed cropping systems in order to quantify carbon sequestration potential and greenhouse gas impacts.

Partners

FiBL cooperates very closely with national research institutions and universities, and also with practitioners, the industry and environmental agencies. More than 30 institutions are currently involved in such cooperation.



Organic farming methods can be used to rebuild soil organic matter in degraded farmland. This in turn sequesters carbon. FiBL is developing methods for optimising this process and measuring it under real-world conditions. Farmers thus gain opportunities to earn carbon certificates.

Our goals for 2025

FiBL is a scientific reference in the area of climate change and agriculture, with a specific focus on organic farming. A standard methodology for carbon analytics within the framework of the ÖLN scheme in Switzerland (Proof of Ecological Performance; minimum standard as a prerequisite for receiving direct payments), and for a possible CO₂ compensation mechanism, has been developed and evaluated. The currently inadequate knowledge about some fundamental processes has been significantly expanded and deepened. These processes include the dynamics and extent of carbon sequestration, the influence of humus formation on soil-borne nitrous oxide emissions or the role of roots in humus formation. Optimised models enable the calculation of the total emissions of organic fertilisers, from production and storage to application. New greenhouse gas inventory methods model the performance of agricultural production systems as a whole. Along with food production, performance includes ecosystem services such as the protection of soil, water and air resources, and also biodiversity conservation.

FiBL is identifying measures for optimum adaptation of organic farms to climate change. In particular, measures are being tested on commercial farms, and synergies or goal conflicts with other issue areas (such as agroecology) are evaluated. The water regime of organic farming systems in Switzerland is playing an increasingly greater role. FiBL is involved in the field of biological plant protection and is simulating the interaction of pests and beneficial insects as well as the influence thereof on important crops. Suitable policy instruments are also being developed, communicated and implemented. These instruments may not discriminate against diverse and complex systems such as organic farms. Quantifying the emissions of such systems is very demanding, and the totality of their outputs is extraordinarily multi-faceted – they produce food, affect public assets ranging from the landscape to soil and water conservation, and they render diverse social and ecological services. Great potential for mitigation also lies in steering consumption behaviour in a “greener” direction and identifying appropriate measures for agricultural advisory services.

Summary

Agriculture is not only a contributor to the increasingly perceptible climate change, but is also impacted by it. International policies (4 out of 1000 initiatives) and the Swiss federal agricultural and environmental agencies therefore give high priority to climate research. In both field and laboratory experiments conducted over the last three decades, FiBL has created a solid basis for mitigating and adapting to climatic change in agriculture, and has published widely-read overviews on these topics. FiBL enables the quantitative assessment of various agricultural measures for sequestering carbon and reducing greenhouse gases. Methods for rapidly determining soil carbon levels via spectroscopy, coupled with soil depth profile analyses, are being developed for commercial use on a large scale. FiBL is actively monitoring the current climate-induced changes with respect to harmful organisms, the water regime and nutrient cycles. The spread and reproduction of harmful and beneficial insects under future climatic conditions is also being simulated. Governance tools with which to promote climate-friendly farming are being developed for policy-makers. This will permit efficient action to adapt to climate change on organic farms. To this end, emphasis is being placed on a holistic systems approach that takes all relevant ecosystem services (e.g. climate regulation, nutrient and water cycling, pest and disease management, maintenance of biodiversity) into account.

Funding

Projects and contracts are financed by Swiss government, EU and non-profit foundation funds. In view of the major challenges, FiBL wants to increase the resources for research and implementation with farmers by CHF / EUR 3 million per year.

Contacts

Markus Steffens, Adrian Müller, Sibylle Stöckli, Axel Wirz, Hans-Martin Krause, Paul Mäder and Thomas Lindenthal

Core mission 7: Improving the sustainability of agriculture and the value chain

Introduction

While the way in which food is produced has contributed to huge improvements in the food supply in large parts of the world, it has had major impacts on the environment. The use of bought-in animal feed, fertilisers and pesticides has resulted in greatly diminished species diversity. Distorted conditions of competition and trade that fail to take sufficient account of the externalities of agriculture put at risk the sector's economic and social viability. The direct payments for more environmentally friendly agriculture that were introduced 25 years ago have not changed this situation to any significant extent.

Mission

Using high-quality data and models, FiBL is developing options for sustainable food production and nutrition. It provides scientists, farmers, businesses and policy-makers with methods and tools with which the sustainability of food production can be quickly, reliably and economically measured and assessed. FiBL devises approaches to food policy that are designed to remove the narrow focus on agricultural policy. These solutions optimise the synergies between agricultural, environmental and health policy and minimise conflict. FiBL optimises the interaction between the three sustainability strategies of efficiency, sufficiency (moderation/reduction of demand) and consistency (consideration of qualitative factors and values/ecological compatibility) in order to provide society and policy-makers with a wide range of sustainable agricultural, consumption and food systems.

Activities

In 1977 FiBL organised the first international scientific conference of IFOAM – Organics International (the International Federation of Organic Agriculture Movements), which was held in Switzerland under the slogan “Towards a Sustainable Agriculture”. FiBL currently has more than 40 researchers working on sustainability issues. This work is to be significantly expanded to include:

- Sustainability of the regions. Spatially-explicit analysis of how different food systems, policy interventions or label programmes impact on the sustainability of regions in the context of planetary and local ecosystem boundaries.
- Which path should be taken? FiBL works on options and strategies for the transition to sustainable food systems for policy-makers, the farming sector, and value chains. This creates transparency with regard to sustainability performance.
- Policy instruments and policy models. FiBL creates and examines policy instruments for implementing the sustainability strategies of sufficiency, consistency and efficiency and considers new policy models that advance sustainability for the benefit of society and agriculture. These approaches include true cost accounting, management options at the levels of production and consumption, and sustainability bonuses



Christian Schader, Adrian Müller and Anita Frehner calculate the sustainability of small farms, using hundreds of indicators. The wealth of information is growing rapidly in all fields. Disciplines have now become so complicated that they can only be modelled by using algorithms. FiBL's researchers are therefore supported by IT experts.

as a means of rewarding the ecosystem services of agriculture. In the field of sustainability monitoring, FiBL explores the potential of remote sensing and big data.

- Thinking more broadly about organic farming. FiBL devises ways of developing organic agriculture and studies management practices with the aim of improving the sustainability of agricultural production worldwide (reducing pesticide use or avoiding it entirely; new methods and technologies for closed nutrient cycles, a finite phosphorus supply, a sustainable nitrogen supply, optimising nitrogen fixation, organic fertilisers, mineral nitrogen).

Methods

FiBL's research in the field of sustainability assessment is based on a broad view of sustainability that encompasses ecological integrity, economic resilience (robustness), social wellbeing and good governance in accordance with the guidelines of the Food and Agriculture Organization of the United Nations (FAO). FiBL works with customised, state-of-the-art methods at the levels of product, technology, value chain, farm/company and sector. It concerns itself with life cycle assessment (LCA), a global mass flow model (SOL; www.fibl.org > Projects > enter 35088 in the search box), geographical information systems (GIS), econometric models, policy analysis and policy evaluation. The FiBL "Farm Model" addresses the economic and



Lukas Baumgart discusses various farm improvement options with farm manager Fritz Sahli in Switzerland.

ecological optimisation of farms including the interactions between the various arms of the business. The Sustainability Monitoring and Assessment Routine (SMART) is a multi-criteria analysis that can be used to perform a comprehensive sustainability assessment.

Partners

Many research institutions and universities are FiBL partners, as are processing and trading companies and producers and label organisations that specialise in organic products and sustainability. FiBL works with more than 50 institutions in this area.

Our goals for 2025

FiBL tests new models for Swiss and EU agricultural policy on farms. These policy models are ready to be put into practice in Switzerland's Agricultural Policy 2022+ and the EU's common agricultural policy post-2020. Regional sustainability assessment models supply the facts

for environmental schemes specific to particular regions, and powerful tools enable competition for the best solutions for sustainable food production and nutrition. FiBL publishes basic information on the synergies and conflicts between sustainable food production and sustainable consumption. The facts on the capability of different land-use systems (organic agriculture, conventional agriculture, agroecology, low-input farming, agroforestry) in various global contexts have been published and can be utilised by numerous research groups. Technical and methodological innovation has eased the implementation of sustainability in politics, trade and the farming sector. With its partners, FiBL is the leading provider of sustainability assessment tools.

Summary

The “greening” of agriculture that commenced in the 1990s has failed to fully solve the environmental problems of food production and has not resulted in a sustainable agricultural system. There is a need for new strategies for sustainable agriculture and nutrition that permit a variety of approaches and consider production hand in hand with consumption and nutrition. A basic requirement for the design of sustainable food systems is that sustainability must be capable of being simply and reliably measured and assessed. Building on this principle enables competition for the best solutions for sustainable food production and nutrition.

Funding

The studies are financed by projects and contracts commissioned by the Swiss government and the EU, by charitable trusts and by innovative companies. Because the sustainability of agriculture and nutrition is becoming the most important issue for our future and objective criteria and methods must be developed, FiBL plans to expand this research by CHF / EUR 4 million per year.

Contacts

Christian Schader, Matthias Stolze, Richard Petrasek, Ruth Bartel-Kratochvil, Thomas Lindenthal and Robert Hermanowski



Not all consumers can travel to the market or on-farm shop each week. But they still want to know how the products are produced and how reliable the checks are.

Core mission 8: Making value chains transparent and securing the long-term trust of consumers

Introduction

Worldwide sales of organic food in 2018 totalled more than CHF 90 billion. The USA and Europe are the most important market outlets for organic products, while the majority of the world's 2.7 million organic farmers live in India, Uganda and Mexico. Organic agriculture is thus a global market. Because it is impossible to tell from its appearance whether an apple or a yoghurt has been organically produced, transparency and consumer trust are crucial to the sale of organic products.

Mission

To make organic value chains transparent, we produce up-to-date statistics, information and background notes on organic agriculture worldwide, thus providing reliable and clearly set out reference material that can be easily accessed by anyone. We develop social, organisational and technical innovations to modernise and improve organic quality assurance systems – innovations that can be applied both globally and locally.

Activities

FiBL has been collecting and publishing data on worldwide organic production and organic markets for almost 20 years. Five years ago it also started collecting data on other sustainability labels such as Fairtrade. For 20 years

FiBL was responsible for organic certification in Switzerland; in the early 2000s this work was outsourced to the private company bio.inspecta AG, with which FiBL continues to work closely. This collaboration enables both institutions to make the best possible use of their expertise in the field of certification. FiBL has been conducting consumer research for the past 30 years. It maintains several databases (such as OrganicXseeds) that provide information that is important for certification. It has more than 30 staff members working on the issue of transparency and consumer trust. This work is to be significantly expanded to include:

- FiBL information systems. Data, statistics and information on organic agriculture worldwide will be linked to our research findings. This makes it possible to “zoom in” on organic agriculture so that the questions that can be answered are not restricted to “How and where are organic apples grown?” but include “How sustainable is production of organic apples in New Zealand and Switzerland?” and “What quality do consumers expect?”
- Information technology to increase the transparency of organic value chains. Linking and systematic analysis of existing and future data (big data analytics) to increase

transparency and optimise risk analysis and the procurement of goods in organic agriculture by developing “control intelligence”.

- Geodata from the air and from satellites: information technologies for organic management and quality assurance systems. Yield estimates, determination of harvest dates and qualities, estimates of carbon sequestration, land-use change on the basis of e.g. the European Copernicus Land Monitoring Service (CLMS) and hyperspectral remote sensing (e.g. Sentinel satellites, HyMap).
- Analysis of new technologies. Analysis of the potential of blockchain technology for radical modernisation of organic quality assurance systems. This will involve evaluating concrete applications in value chains. Investigation of the economic and social impacts of digitalisation on organic agriculture in terms of opportunities for ecological improvements (see core mission 2).
- Biobarometer Europe. Annual analysis of the behaviour of organic consumers, consumer trends, the motives of organic buyers and the obstacles to buying organic (online survey).
- Modernisation of monitoring systems. The strengths and weaknesses of group certification and participatory guarantee systems (PGS) are studied. These monitoring systems are then refined to make it easier for smallholders to access the organic market and ensure that they comply with organic guidelines and meet consumer expectations.

Methods

The activities of this mission require an interdisciplinary

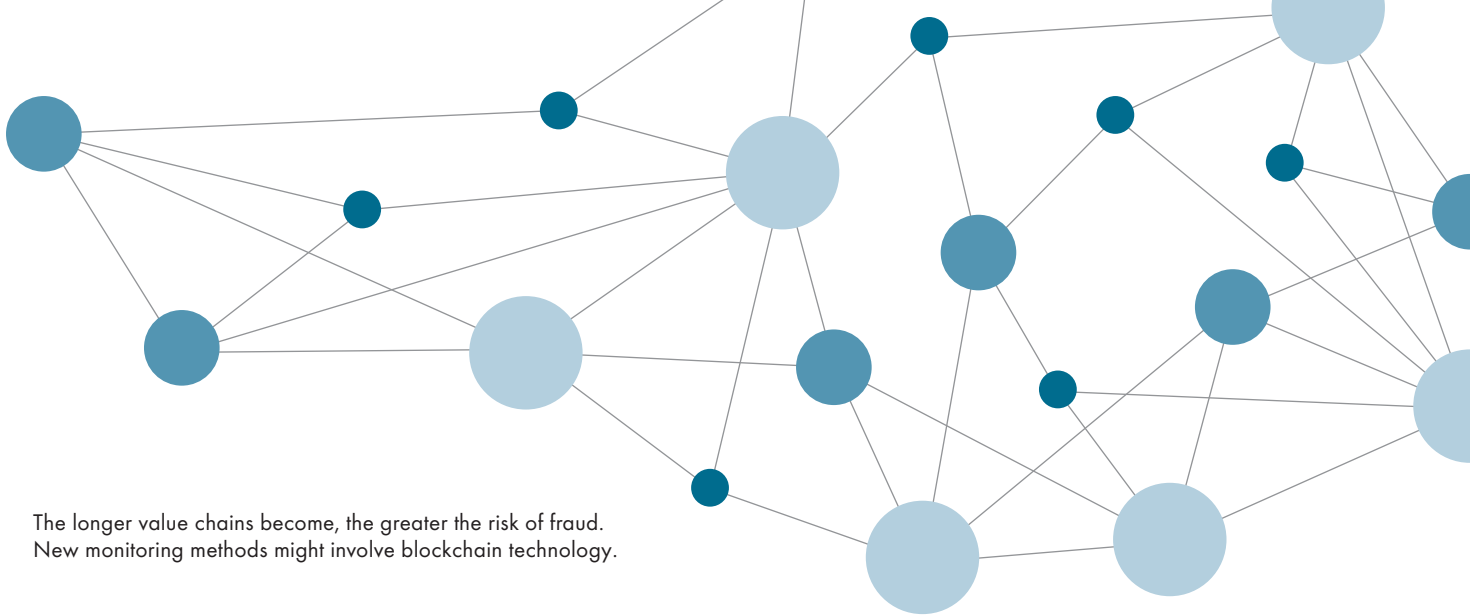
approach that draws on the knowledge of IT experts, agronomists and social scientists and on expertise in communication. We use the following methods and tools: econometric and statistical methods, big data technologies, machine learning, case studies, scenario labs, quantitative and qualitative interviews and online surveys on FiBL’s server.

Partners

Computer science research institutes, start-up companies, national and international organic agriculture associations and monitoring bodies, various universities and research institutions in Switzerland and other countries, UN organisations, a network of data collectors, various government agencies. FiBL works with more than 100 institutions in connection with the issue of transparency and consumer trust.

Our goals for 2025

By 2025 the FiBL information system is the key hub for data on organic agriculture. A data platform for the linking and systematic analysis of data has been set up and programmed, pilot projects in collaboration with organic organisations have been completed. The FiBL databases are linked to geodata. Initial analyses of big data have been published and initial services are available to the organic sector. The principles of using blockchain technology in food value chains have been drawn up and published and provide a basis for further research. Accompanying social scientific research into digitalisation in organic agriculture has been concluded and published. A discussion paper on modernisation of the organic monitoring system has been produced and is being discussed with sector representatives. The Biobarometer is produced annually in Europe and the findings are published at the Biofach trade fair. Market stakeholders have access to representative findings.



The longer value chains become, the greater the risk of fraud.
New monitoring methods might involve blockchain technology.

Summary

In view of trends including the increasing distance between producers and consumers and the growing size of the market, innovative information and quality assurance systems are needed to ensure transparency, traceability and trust. FiBL investigates and tests the opportunities and limits of information technologies and uses the information gained to develop concepts and services for the organic sector in order to modernise organic quality assurance systems, boost their transparency and reliability and hence increase consumer trust in organic agriculture.

Funding

These studies are based on a number of FiBL's existing activities and on data that it already holds. Developing them into a comprehensive information and quality assurance system costs around half a million CHF / EUR per year.

Contacts

Matthias Stolze, Sylvain Quiédeville, Beate Huber, Helga Willer, Rolf Mäder and Isabella Gusenbauer

Core mission 9: Organic advisory services of the future – the digital advisor and the personal discussion

Introduction

Organic agriculture is expanding all over the world and the increasing number of organic farms is resulting in increased demand for information on production techniques, species-appropriate livestock husbandry, the economic and social aspects, and relevant networks. This information is complex and diverse. It encompasses production, environmental performance, animal welfare, natural resources and social aspects. However, data and algorithms generated by the machinery and food industries are unsatisfactory when it comes to their coverage of the organic farming system. An autonomous organic advisory system that uses modern methods of knowledge transfer is therefore essential for effective knowledge transfer and use. Such a system provides scope for human encounters and collective problem-solving.

Mission

FiBL expands its advisory expertise and, in the future, offers its services partly via computer-based advice systems (e-advice) to supplement more in-depth personal discussions and in combination with on-farm research. E-advice is used mainly to answer routine queries. It gives good practitioners greater security and it responds to elevated risks (extreme weather, development of populations of important harmful organisms, volatile markets). FiBL's pool of advisors and experts can focus on strategic issues

that affect practitioners and be deployed for complex challenges. On-farm research deepens mutual understanding between research and practice and makes site-specific solutions possible. FiBL is the first institution to offer comprehensive e-advice.

Activities

FiBL's databases and consultancy tools mean that it has a store of knowledge that is unparalleled in size and that is continuously updated and expanded. FiBL has been advising organic farmers in Switzerland and internationally since 1977. More than 40 staff members at FiBL provide advisory services. The following services are to be expanded:

- E-advice. If it is not already in digital form, existing information on all aspects of organic agriculture (production, market, possible subsidies, service providers, networks) is digitalised and saved in FiBL's databases. An organic-specific search function will be provided on the FiBL advisory websites bioaktuell.ch, bioactualites.ch and bioattualita.ch (with voice control, i.e. questions can be asked by voice). Location-specific knowledge will be included and machine learning will make the e-advice ever more precise. To complement FiBL's organic-specific knowledge, farmers' knowledge will be systematically and continuously collected and inputted.



Maurice Clerc prefers face-to-face discussions.



Young farmers, on the other hand, are increasingly turning to the Internet. FiBL plans to digitalise its entire knowledge base and leave routine queries and advice to a smart e-bot.

- Expansion of web presence. The permeability of information between FiBL's websites will be increased. For Switzerland this includes the trilingual website bioaktuell.ch, the European website farmknowledge.org and numerous websites of Swiss and international research projects.
- Specific advisory tools as online tools for smartphones and tablets. These include instructions on cultivation techniques (previously available as printed and PDF information sheets), lists of cultivars and inputs and simple checks of the sustainability of the user's farm. Online management systems that can be used by experts to monitor plant pests and plant and animal diseases are another example.
- Production of advisory videos. FiBL has a YouTube channel with 400 short videos. 3.8 million visits and 6000 subscribers make FiBLFilm one of the most important agricultural video channels both nationally and internationally. These videos have proved useful in consultancy and training. Furthermore, videos are an excellent way of making farmers' knowledge and experience accessible. The material on offer is to be further expanded in terms of languages, regions and content.
- Providing advice via the media that farmers use every day. The media used by FiBL for advisory purposes include Twitter, Facebook and WhatsApp.

Methods

FiBL works in groups of scientists as well as advisors and knowledge brokers who have been trained in methodology. For e-advice and e-learning FiBL calls in software companies and supplements its own teams with additional experts in the fields of internet programming, databases and the development of algorithms. The close collaboration between research, advice and practice that has developed at FiBL enables the appropriateness, practical relevance and weighting of the knowledge to be constantly reviewed and improved. Advisory activities cover the entire value chain and are expanding in geographical scope. New language versions are added on an ongoing basis.

Partners

All partners of LIWIS (Swiss Agricultural Knowledge and Innovation System) and AKIS (Agricultural Knowledge and Innovation System) in Europe and worldwide. FiBL works with more than 100 institutions in connection with advisory services and knowledge transfer.

Our goals for 2025

By 2025 the knowledge gaps in organic agriculture have been largely closed due to improved access to information, rapidly expanding research and development findings, the detailed involvement of experts, learning algorithms and collaboration with partners in Switzerland and other countries. The FiBL advisory service has more

capacity for strategic advice and complex problems. The e-advice service answers questions about production (soil, plants, animals), family, business development and markets and does so completely confidentially, anonymously and free of charge.

Summary

The organic advisory service of the future will be developed in three main areas: e-advice, more extensive personal consultations and joint on-farm research and development work. In accordance with this core mission, the first of these areas in particular – which FiBL is just beginning to use – will be greatly expanded and professionalised by employing people who are experts in their fields. This means that physical distance will in future be less important than it is today. Building on existing strengths, a large number of cooperative projects and the further development and use of existing potential, FiBL's pioneering role in agricultural innovation and knowledge systems will be further strengthened.

Funding

The content and methodology of FiBL Switzerland's organic advisory service will be further developed in selected areas. There will be an increasing emphasis on knowledge transfer as a focus of the work of FiBL Germany and FiBL Austria. Important funders are the Swiss, German and Austrian governments, the Swiss cantons and the EU, because knowledge transfer is one of the priorities of Eu-

ropean research coordination. FiBL will also spend an additional CHF / EUR 1.5 million per year on adapting to the changing communication habits of young farmers.

Contacts

Robert Obrist, Helga Willer, Elisabeth Klingbacher and Vera Bruder

Core mission 10: Organic farming's contribution to sustainable development in the countries of the global South

Introduction

By 2050 more than half of the world's population will live in the tropics. Coupled with this is a rising demand for food in regions where poor agricultural productivity, hunger and poverty are widespread. While in the past the solution was seen in simply steering agriculture towards an increase in production (the "green revolution"), it has now been recognised that more sustainable strategies are required. According to the FAO, what is needed to achieve the United Nations Sustainable Development Goals (SDGs) are measures such as diversification in agriculture, improvements in soil health, protection of ecosystem functions, and greater stress tolerance in agricultural systems.

Organic farming therefore has huge potential to help realise the sustainability goals. However, research has so far concentrated on temperate climate zones, and the results are not always transferable to tropical and arid zones, for example, which are particularly affected by poverty and hunger. FiBL's research findings show that despite some lower yields for smallholder families in the global South, organic farming and other agroecological methods can be economically more interesting than conventional methods, since they require less capital and can achieve a better return for the work involved. The yield potential in these regions is far from being exhausted, as too little is known

about how organic farming concepts can be implemented practically and optimised with the farmers' traditional knowledge, for instance to tackle the pressure of pests and diseases in the humid climate of the tropics, or to maintain or improve soil fertility in the face of soil degradation and a lack of organic matter and humus.

Mission

FiBL boosts the contribution made by organic farming to sustainable development in line with the United Nations 2030 Agenda by highlighting in its research results organic farming's potential in (sub-)tropical and arid regions, i.e. in regions hardest hit by poverty and hunger. Together with its local partners, FiBL promotes innovations and optimises farming and agroforestry systems for crops of particular importance to smallholder families, to enable them to maintain their natural livelihoods using organic growing methods, improve their income and contribute to food security.

Activities

In 2007 FiBL commenced the long-term farming systems comparison in the tropics (SysCom), the first long-term trial in the tropics to compare organic farming methods with other types of farming. Since then there has been a steady increase in interest in collaborating with FiBL on

research focusing on the specific needs of countries afflicted by poverty. In total more than 40 specialists at FiBL are involved in development cooperation. The following activities will be expanded:

- Evaluating and optimising growing systems. FiBL is comparing productivity, profitability, environmental impact and the social benefits of organic farming with other growing systems. The strengths and weaknesses identified will influence future research programmes on environmentally-sound intensification which deal with the problems of small-scale farmers and family farms (for example, soil fertility, crop protection, efficient use of water and nutrients, crop planning). FiBL is optimising the organic and other agroecological cultivation methods for selected crops such as cacao, palm oil, cotton, vegetables, legumes, rice and yams at the field and farm level, as well as improving livestock farming.
- Nutrition-sensitive Agriculture (NSA). A healthy diet is the focus of the agricultural production promoted by FiBL and its dependent value chains, which extend right into the cities. It is achieved by producing nutritious food in diversified farming systems, which make a varied diet possible, and by processing, preserving, storing and marketing in a way that conserves nutrients and prevents contamination and impurities. It also involves promoting unused or unfamiliar crops with high nutritional value.
- Thinking in the context of the United Nations Sustainable Development Goals (SDGs). FiBL constantly reviews the relevance and findings of its research in the context of the SDGs. It links its activities to the SDGs using a standardised reference system with 90 SDG subsidiary targets of particular significance for agriculture. We use the strengths of organic farming and expand its possi-



The promotion of Nutrition-sensitive Agriculture is contributing to a healthy diet for the rural population of Peru's mountain regions.

bilities, such as affordable certification, urban farming and e-farming for producer groups, in order to work towards the SDGs.

- Dialogue and international cooperation. In close cooperation with our partners, FiBL uses intensive public relations to communicate research findings at the regional, national and international level, firstly so that these are available to farmers and secondly so that they contribute to international dialogue on global and regional challenges. FiBL is strengthening institutional capacities in the countries of the global South through participation in projects and networks and through technical and institutional innovations and better market integration of organically-produced food.



Innovative composting methods are demonstrated at a SysCom project workshop in Kenya.

Methods

FiBL is researching how organic farming can contribute to sustainable food security, poverty reduction and rural development, both on the basis of data from long-term trials and surveys on working farms and by using environmental and economic models. Modern evaluation and impact assessment methods (see core mission 6) enable sound assertions to be made on the current performance and the optimisation potential of organic farming. FiBL carries out interdisciplinary and transdisciplinary systems research through participatory initiatives such as innovation platforms, thus developing and optimising environmentally, socially and economically robust systems. By using established sustainability assessment methods and environmental socioeconomic models at field, farm and regional levels, it is possible to make a comprehensive evaluation of the agricultural and food systems. The analysis of goal conflicts or synergies between economic, social and environmental aspects helps stakeholders in government, industry and society to make evidence-based decisions.

Partner

Our partners are, firstly, national research organisations, universities and international research centres, including members of the Consultative Group on International Agri-

cultural Research (CGIAR), who operate in Africa, Asia and South America. Secondly, FiBL works closely with farmers' and consultancy organisations, market partners and NGOs. National and international government agencies, trading and production companies, and foundations all support FiBL's work.

Our goals for 2025

National and international decision-makers such as the UN organisations FAO, IFAD and CFS, the EU, as well as governments, private donors, landowners and civil society organisations recognise the potential of organic farming to provide food security, reduce poverty and promote rural development. This addresses key social challenges such as population growth, unemployment, rural exodus and migration, climate change, resource depletion, loss of biodiversity and water pollution. The initiatives and projects, which are based on sound knowledge, have substantially boosted the attractiveness of organic farming for industry and society. Optimal organic and agroecological farming and production methods for selected crops, agroforestry and animal husbandry systems in various climatic regions have been developed and will make it possible to improve livelihoods, boost the local economy and make food systems healthier and more sustainable.

Summary

FiBL is strengthening the contribution of organic farming and other agroecological methods to sustainable food security, poverty reduction and rural development through innovative research and development projects. FiBL generates and devises

- robust data on the productivity, profitability and sustainability of organic farming systems,
- resilient farming systems with optimal cultivation and production methods for selected crops, agroforestry and animal husbandry systems in various agricultural regions,
- innovative approaches for rural, peri-urban and urban food systems.

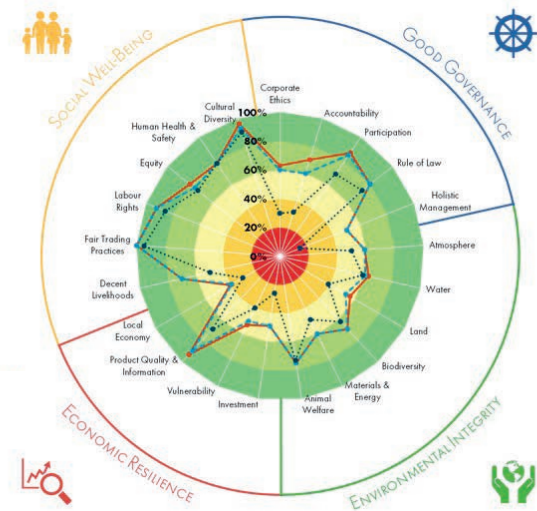
FiBL's work emphasises organic farming's contribution to achieving the SDGs by linking its research and development activities to the SDGs via a standardised method.

Funding

FiBL's work in developing countries is predominantly funded by development and economic cooperation institutions in Switzerland, Liechtenstein and Germany, the EU, charitable foundations and committed businesses. As the projects will have a major long-term impact, FiBL intends to invest a further CHF / EUR 5 (to 8) million per year.

Contacts

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Brian Ssebunya, a Ugandan PhD student at FiBL, analysed the sustainability of 180 coffee producers (arabica and robusta cultivars). The producers working to organic and Fairtrade standards (red line) were the most sustainable, followed by the Fairtrade producers (blue line). Some of the conventional producers with no standards (black dotted line) were in the unsatisfactory zone (red and yellow).

Core mission 11: FiBL campus – Agroecology and organic farming need interdisciplinary and trans-disciplinary education and training

Introduction

The sustainable development of agriculture requires outstandingly trained managers, advisers, researchers and other stakeholders in the value chain with excellent technical knowledge in diverse specialist disciplines of agriculture and the food industry. In order to be successful in organic farming, an additional requirement is in-depth knowledge of the specific methods of organic farming, its ethics and its regulatory structure, which is set out in numerous statutory provisions, private guidelines and quality assurance standards.

To meet the future challenges for agriculture and food (for example, climate change, planetary ecosystem boundaries), the ability to manage complexity and harness systemic effects is particularly important. Agriculture must be understood by all professionals in society in the context of landscape, regional development, food, industry, politics and society. Where better to learn, practise and reflect on all this than on a campus where there are unique and extensive skills in research and guidance on organic farming and the concept of the agroecological systems approach?

Activities

Every year FiBL attracts around 70 young people who complete part of their education with us (Bachelor's and master's theses, internships, postdoctoral research, job shadowing, apprenticeships). FiBL regularly runs summer schools for students and provides further training for professionals as well as courses in organic agriculture. FiBL is involved in the undergraduate and master's degree



Students from all over the world work with FiBL's research teams.

courses at ETH Zurich, ZHAW Zurich University of Applied Sciences and Bern University of Applied Sciences (BFH). In addition, FiBL staff have teaching roles as professors and lecturers at universities in Germany, Switzerland and Hungary. The following activities are to be expanded:

- Digitalisation of teaching materials. Digitalised teaching materials are being developed for various national and international target groups and for different climatic, agroecological and socioeconomic conditions. These include online courses, moderated e-learning training and further education programmes, and specially prepared online information materials and video clips that can also be downloaded via mobile phones.
- Coaching and networking. Managerial and advisory staff, teachers and people employed in the sector are instructed in the specifics of organically managed agroecosystems. They achieve high-level skills in production techniques, in understanding relationships and in developing collaborative projects.
- Summer and winter schools. FiBL regularly offers intensive national and international courses covering various themes along the value chains of organic systems. Methodological skills and knowledge are taught practically in an interdisciplinary learning environment. Various porous teaching models are being developed for these courses, so that practitioners and academics complement each other's input.
- Master's degree course in (agro)ecological farming. A complete master's degree course will be developed in collaboration with a university either in or outside of Switzerland (the curriculum, training of teaching staff, teaching materials, teaching infrastructure, a campus with



Hands-on livestock farming: Michael Walkenhorst and his students assess the body score index of dairy cattle.

accommodations, practical training opportunities on farms, integration in FiBL research and advisory projects, study grants for foreign students). This course will be strictly aligned to the systems character and will be interdisciplinary. The teaching, assignments, research projects and excursions will go far beyond single disciplines, which necessitates teaching staff to be trained accordingly.

- FiBL Future Forum. To bridge the gap between knowledge and (political) action, a new forum format is being set up based on the existing structures at FiBL. The forum will address the most pressing national and international issues of the time. It will be composed of high-calibre members and will use FiBL's unparalleled facilities: excellent modern conference infrastructure situated in an agricultural landscape, and accessible research infrastructure with 250 projects and practical farming.



Claudia Daniel discusses pest control with students in the orchard.

Methods

The foundation for e-learning courses already exists as a result of projects funded by the United Nations Environment Programme (UNEP) and the Swiss National Science Foundation. Many agricultural colleges in Africa use the African Organic Agriculture Training Manual (www.organic-africa.net > Training Manual), an online teaching aid devised by FiBL. Based on this, we are developing a complete e-learning programme suitable for different devices and technologies, so that it can also be used, for example, with mobile phones or as an offline version. This is especially relevant in low-income countries. Selected online courses are open to interested people worldwide in the form of Massive Open Online Courses (MOOCs), which means they are seen and disseminated on a large scale. Considerable importance is placed on the training of internal specialists as online and personal mentors, as well as on direct usability by farmers. Relationships with other advisory and training institutions are being strengthened in order to introduce innovative techniques and processes. Modules in agroecology and organic farming are being introduced in the CECRA (Certificate for European Consultants in Rural Areas) training programme. The present range of courses run by FiBL lecturers is being unified and

provides an extensive pool of knowledge and methods. In 2020 large sections of the new FiBL campus will be available, with two auditoria, five classrooms and a restaurant, and student accommodation will be secured. Curricula for the various courses will be publicised and the integration of teaching and research will be operational. Cooperation with other training providers will be regulated institutionally and will produce major technical and economic synergies.

Partners

All partners of the Swiss Agricultural Innovation and Knowledge System (LIWIS), in Europe and worldwide. There are numerous partnerships with vocational colleges, technical colleges and universities in and outside of Switzerland. A partnership between FiBL and a suitable university is being established for the master's degree course in (agro)ecological farming.

Our goals for 2025

The four new training schemes described in the "Activities" section are in demand worldwide, and the number of participants covers the bulk of the costs. It is a win-win situation in many ways, as education and training are combined with research, advisory services and input from international experts. Through its international network, FiBL links the leading education and research institutions. It directs and coordinates interdisciplinary and transdisciplinary training in organic farming, helps

people to move into organic farming and motivates them to develop it further.

Summary

FiBL is bringing together its many separate education and training programmes for organic farming, agroecological systems, and animal health and welfare. The resulting campus for (agro)ecological farming is becoming a magnet for accessible education and training for people from vocational level to degree level and includes the integration of the entire value chain. Learning takes place via several attractive types of courses (e-learning, summer and winter schools, interdisciplinary master's degree courses and the futures forum). Content and industry-related synergies are being developed between teaching, research, international consultancy and practical advice.

Funding

The education and motivation of young professionals is a by-product of FiBL's numerous research and advisory activities. In order to train a large number of future stakeholders in organic farming and agroecology, FiBL intends to invest a further CHF / EUR 1.5 million per year.

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