

World Food System Center Research Program on Smart Sustainable Farming

Call for Proposals

Call 3: open from 01 August to 31 October 2024

Zurich, August 2024

1. Background and scope

In 2021, the fenaco cooperative and the World Food System Center at ETH Zurich expanded their existing partnership, jointly initiating a long-term research program on Smart Sustainable Farming. To fuel this partnership, fenaco has provided 1.2 million CHF of research funding, thus enabling interdisciplinary projects in the field of agriculture and food systems at the doctoral and postdoctoral level. The aim is to develop new, applicable knowledge in the field of sustainable agriculture and new technologies (i.e., artificial intelligence, data science and/or robotics). The emphasis lies on fostering collaboration between research and practical applications, alongside employing interdisciplinary, solution-oriented research methodologies. This involves integrating expertise from fields such as agronomy, agricultural science, and breeding, with advancements in robotics, data science, and AI, all geared towards addressing real-world challenges in Swiss agriculture.

The program is structured around annual calls that will fund up to 3 projects per call of in general 2-4 years duration, with a maximum budget of 200'000 CHF per project. With this support, five to six projects are to be realized in a first phase.

2. Call topics

This research program is intended to facilitate projects with the aim of developing knowledge, technologies, and innovative methods and processes that combine the expertise available at ETH Zurich in the fields of agronomy, agroecology, breeding, robotics, data science, AI, economics, and management in the best possible and most profitable way. The focus of these projects is on Swiss agriculture. However, generated knowledge and experiences are also applicable to other geographical or agro-climatic contexts.

All projects based on an interdisciplinary research approach that address one or more of the following focus topics are invited to submit projects:

- Reducing the footprint of agricultural production
- Strengthening the quality of products and improving transparency along the production process
- Improving the competitiveness of sustainably-produced products
- Strengthening biodiversity
- Reduction of the climate impact of production and strengthening the resilience of agricultural production to climate change.

We also welcome projects that are thematically or methodologically linked or build on the ongoing research within the program. In Section 3, you will find brief descriptions of the current projects, which may help you identify potential connections to your research topics and interests.

For both options, interdisciplinary research approaches should combine at least two research groups, ideally combining an agronomic perspective with a technical, computational, data-based, or socio-economic perspective. Projects representing or containing feasibility studies, proof of concepts and milestone driven projects are encouraged.

We also encourage using the experimental infrastructure available at ETH Zurich relevant to these research fields, in particular AgroVet Strickhof and the ETH Research Station for Plant Sciences.

If you are planning to submit a proposal, you are strongly encouraged to join our **on-site Workshop** jointly organized by WFSC and fenaco on **09 September 2024, at 10:00 CEST at ETH CHN E 46**. The workshop brings together researchers from different disciplines (AI, robotics, agricultural science) interested to add a proposal with the organizers of the call, and with representatives of fenaco. The aim is to provide information about the program and ongoing projects, facilitate discussions on potential topics, and support the co-creation of project proposals.

3. Funded projects

So far, three projects have been funded through the previous calls for proposals.

(I) **The predictive power of smartphone imaging to increase sustainability of crop production** (Call 2022)

Postdoctoral Researcher: Dr. Lukas Roth, Crop Science, ETH Zurich

Principal Investigators: Prof. Achim Walter, Crop Science, ETH Zurich; Michele Volpi, Swiss Data Science Center

The project focuses on the use of smartphone imaging to increase sustainability of crop production. Management decisions in crop fields are based on both crop and field traits. The goal of the new project will be to improve decision support of farmers, based on high-quality visual representations of the past, current and projected future status of the crop field. By collecting smartphone images of crop fields at points in time, field visualizations will be created using a combination of machine learning, crop growth models and visualization technologies. Farmers could then receive visual renditions of the past and near-future development of their crops.

The core outcome is to improve decision support for farmers. Also, the visualizations can demonstrate to interested researchers and citizen scientists how crops develop in the field and how this can be adjusted via management.

(II) **Genetic and robotic technologies for pest detection in vineyards** (Call 2023)

Principal Investigators: Prof. Stefano Mintchev, Environmental Robotics, ETH Zurich;

Prof. Loïc Pellissier, Ecosystems and Landscape Evolution, ETH Zurich

Pest invasions and outbreaks lead to substantial crop losses and economic damages in Switzerland and worldwide. Traditional detection methods like visual inspections, traps, and remote sensing are often insufficient in detecting early-stage invasions. This new project focuses on combining robotics and genetic technologies to overcome the limitations of traditional pest

detection methods. Utilizing drone-enabled sampling of environmental DNA (eDNA) and near-real-time analysis with the CRISPR-Cas system, the project aims to detect two invasive species American grapevine leafhopper and the Japanese beetle found in Swiss vineyards.

(III) ChemiResistive sensors for effective Agricultural N management and N₂O mitigation (Call 2023)

Investigators: Prof. Máté Bezdek, Functional Coordination Chemistry, ETH Zurich; Prof. Nina Buchmann, Grassland Sciences, ETH Zurich; Dr. Eliza Harris, Swiss Data Science Center

Addressing the challenge of measuring nitrous oxide (N₂O) emissions from agricultural soils, this newly funded interdisciplinary project aims to develop a cost-effective system which offers a continuous monitoring solution and promotes more efficient and sustainable agricultural practices. Nitrous oxide emissions are rarely measured at the farm level, because no simple or low-cost methods are available to monitor nitrous oxide. The project focuses on developing a cost-effective "N₂O Sense" system, utilizing chemiresistor technology for continuous monitoring of nitrous oxide concentrations in soil at various depths. By enabling farm-level measurement and offering a low-cost monitoring solution, the project aims to contribute to the Swiss Nutrient Reduction Initiative's goal of reducing nitrogen losses by 20% by 2030.

4. Eligibility

To submit a proposal to this call, the Principal Investigator (PI) must be a researcher of ETH Zurich. Direct funding is restricted to ETH Zurich WFSC members. Non-ETH Zurich WFSC members can be co-applicants and their expenses can be covered for project costs (consumables, equipment, services, etc.) but they cannot receive funding for scientific personnel (doctoral students, postdocs, etc.).

Eligible are Professors, Senior Scientists and Senior Assistants ("OberassistentInnen"). The PI must thereby be an ETH Zurich employee with at least a 50% position, which must be guaranteed for the intended duration of the project. Doctoral and/or postdoctoral students funded by this program must be supervised either by the PI or a co-applicant.

This call is intended to support interdisciplinary approaches that combine different methods and disciplines. For this reason, a co-applicant from another discipline is highly encouraged. However, external (non-ETH Zurich) co-applicants cannot receive funding from this program.

Proposals submitted to this call will only be considered if they fit to one (or more) of the topics outlined in Section 2.

If applicable, relevant ethical, legal and social considerations should be included in the proposal. The prospective research must also comply with the existing ethics regulations and adhere to the principles of research integrity valid at the ETH Zurich.

5. Duration and Funding

The maximum funding duration per project is 3-4 years for doctoral students and 2 years for postdoctoral researchers. Costs will be covered for an amount up to 200'000 CHF per project.

The following costs will be covered for research projects:

- Salaries for postdoctoral researchers or for doctoral students (based on ETH Zurich standard salary rates at the time of submission)
- Travel
- Consumables
- Education, outreach, communication, and implementation activities

Eligible costs must be directly linked to the project and must be justified in the proposal. Salaries of the applicants and the co-applicants are not eligible for funding. Funding cannot be used for the purchase of new equipment or replacement costs of laboratory and field equipment.

Financial accounts must be administered at ETH Zurich.

The available funding is not divided between specific topics but will be awarded to the best projects. Funding will be allocated at the start of the project for the full duration of the project.

The WFSC is compensated for project coordination, interaction, communication of project results and the organization of workshops allowing to inform about the projects and the program (5% of the project costs, to be added in the project budget).

6. Deadline for proposals and submission procedure

The deadline for the submission of project sketches is: 31.10.2024

Email address for submission: wfsgrants@ethz.ch

Applications and supporting documentation must be written in English using the proposal template enclosed and must be submitted electronically as a single file in PDF format.

The Evaluation Committee (EC) will select proposals in a two-stage approach.

- (I) At the first stage, projects are selected based on a short project sketch of max 2-3 pages (see separate template). This description needs to include information on the scientists/research group(s) involved (interdisciplinary project teams are encouraged); as well as a short description of the project idea covering elements such as e.g. research objectives, duration of the project and rough estimation of costs.

- (II) At the second stage, applicants selected in the first stage are invited to hand in a project proposal (see separate template).

The proposal needs to include:

- A cover sheet in which the main applicant is identified, and basic information is given (position, institution, address, email) and in which the title of the project, funds requested and key words/disciplines as well as the duration of the project are indicated. All co-applicants associated with the proposal must also be clearly identified.
- An executive summary (maximum 400 words)
- A budget outlining the requested funds and justification
- The scientific proposal, including the state of research, the research goals and the research plan, expected milestones, as well as a list of literature references. The research plan should include sufficient scientific and technical details for the reviewers to be able to evaluate the proposal as a whole. The scientific proposal should not exceed 10 pages per proposed project (A4, Arial font, size 11, 1.15 line spacing).
- CVs and relevant publications from the applicants and relevant involved researchers.

The EC evaluates the proposals and makes the final decision by consensus. In case this is not possible, a majority of the members decide.

The submission and evaluation process will follow the following schedule:

| Stage | Start date | End date |
|--------------------------------------|--------------|----------------------|
| Call open | 01.08.2024 | 31.10.2024 |
| Ideation Workshop | | 09.09.2024 |
| Submission project sketch | | 31.10.2024 |
| 1 st evaluation round | 01.11.2024 | 30.11.2024 |
| Decision on first round communicated | | not after 02.12.2024 |
| Submission project proposal | | 31.01.2025 |
| 2 nd evaluation round | 03.02.2025 | 03.03.2025 |
| Final Decision Communicated* | | not after 03.03.2025 |
| Start of research projects* | May-Aug 2025 | |

*Please note that dates for the final decision and start of research may be subject to change.

7. Evaluation Committee (EC)

All projects submitted to this call will be reviewed by the specially created Evaluation Committee, which consists of two representatives of fenaco, three representatives of ETH Zurich and one external person from science.

As a rule, the proposals will be evaluated by the EC. The projects will be evaluated according to the evaluation criteria in Section 8. Where appropriate, the EC may consult external scientific reviewers to evaluate a proposal. In the case where EC consults external reviewers, the timeline defined in the table below is no longer applicable as the 2nd evaluation round would last longer than indicated. In such cases, the project applicant will be informed, and the announcement of the final decision will be later.

The EC will make its funding recommendation to the Vice President Research and Corporate Relations at ETH Zurich, who make the final funding decision.

Notification of the decision will usually be given within three to four months of the submission deadline. Projects may start immediately after approval and at the latest within four months after the reception of the decision letter.

8. Evaluation Criteria

Proposals will be evaluated according to two criteria blocks, namely program criteria as well as against scientific criteria.

Research Program Criteria:

- a. Relevance – How relevant is the proposed project for the program?
- b. Fit to topics of the call – Does the proposed project fit to at least one topic of the call?
- c. Interdisciplinarity – Is the proposed project interdisciplinary?
- d. Transferability – How can the outcome of this project be put in practice?

Scientific Criteria:

- a. Scientific Excellence – Does the proposed project demonstrate high scientific quality? How well conceived, organized and state-of-the-art is the proposed activity?
- b. Originality – Is the proposed project creative and original?
- c. Interdisciplinarity – What is the added value of the interdisciplinary structure of the project? How appropriate is the combination of disciplines? What is the scientific added value from the partners to the project team?
- d. Potential Impact – What is the science and practical impact of the project on the challenges addressed?
- e. Feasibility – Does the project have a reasonable chance of succeeding in terms of resources, management and organization and what difficulties can be expected?
- f. Competence – What is the relevant experience of the project team in the research field of the proposed project?

Based on the criteria listed above, projects will be graded using the following scale:
A: Outstanding | AB: Excellent | B: Very Good | BC: Good | C: Average | D: Poor

Projects that are awarded an overall grade of A will be funded as a first priority. Projects receiving a D in one or both criteria blocks will not be funded.

9. Project deliverables, monitoring and outreach

The project teams are expected to report annually on the progress of the project, the results achieved and the project budget. The Evaluation Committee will be assessing the yearly scientific and financial reports for each project.

A final report is due upon completion of the project, including all relevant outcomes (dissertations, publications, patents, etc.). The WFSC manages the reporting process and prepares the necessary documents and templates.

In cases where the project results are made accessible to a larger public, outreach, dissemination, communication, or educational activities can be developed in consultation and collaboration with the project team and the team of the WFSC executive office.

For detailed information on this program (reporting, communication and outreach, as well as research specifics), please refer to the 'Research Project Guidelines 2024'.

10. Communication and Contact

Any enquiries related to the call, topics, and collaboration should be forwarded to the following contact person:

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