



USAGE-NG

Up-skilling Agricultural Engineering
Next Generation

Laboratory Exercises

Work Package n°: **4**

Activity n°: **4.2**

Date - Version: **21.11.2025**

Document prepared within the USAGE-NG Project with the support of the Erasmus+ Programme of the European Union: 2022-1-AT01-KA220-HED-000089504.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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1 Executive Summary

The activity 4.2. was the backbone of activities of WP 4 as work in the laboratory is fundamental for learning in the realm of agricultural engineering.

2 Overview

USAGE NG allowed to conduct and amplify learning activities that were conceptualized for the laboratory AFI-Lab, unibz, NOI-Techpark. In contrast to activity 4.1., learners were invited to the AFI-Lab to attend hands-on learning courses and lectures on concrete agricultural machines, technologies and instrumental set-ups. Such occasions provide unique possibilities for learning and better understanding. Even more so, when learning is not limited to explanations, but enables concrete tests and exercises. Laboratory exercises bring university students and LLL students to the AFI-Laboratory and introduce them with instruments, technologies and complete test setup.

USAGE NG enabled us to offer learning events of variable detail on contemporary agricultural technologies and machinery. Selected exercises were used to confront unibz students and LLL with relevant problems from the agricultural practise.

Objectives 4.2. of laboratory exercises on specialized farming technologies for students and LLL were realized using specialized and unique technologies available in the AFI-Lab. The exercises related to particular instruments or laboratory set-ups:

- Exercise on **machine safety** and **roll-over stability** on mobile platform. For this particular task the AFI-Lab possess a unique mobile platform where vehicles up to 10t can be tilted in 360°.
- Exercise on **spraying machinery** and **components** under laboratory and simulated real world conditions. AFI-Lab disposes of a wind channel to simulate field conditions.
- Exercise on **crop monitoring** in orchards and vineyards, using a prototype vehicle equipped with scanning devices and optical sensors to monitor orchards (ByeLab).
- Exercise to measure **performance** and **efficiency** of agricultural machines and processes (e.g. cereal production, machine performance) using a set of instruments and sensors.

Laboratory exercises

Date	No. pers	Pers./participants	Topic	Duration (h)	Collaboration
21.11. 2025	6x20 ~120	AgriAlp fair, Bozen	Tractor roll-over safety	4x 0,5	
21.11. 2025	~20	Farmers/contractors, extension service personnel (Beratungsring, local companies)	Overview of technology for chemical plant protection. Problems, state of art in technology, research outlook,	1	SBB, Bring

			value of certification, importance of regular training		
20.11. 2025	6x20 ~ 120	Farmers/contractors, extension service personnel, machine manufacturers (AgriAlp trade fair)	As above	6x1	
20.11. 2025	15	BSc students (unibz)	Discussion of technologies for chemical plant protection. Problems, research outlook, value of certification	1	
19.02. 2025	3	Machine manufacturers (Caffini s.p.a.)	Collaboration on experiments, joint discussion of results, analysis of different prototypes	8	Caffini
21.11. 2024	6x3 ~18	Machine manufacturers (Wanner Sprühgeräte GmbH, others)	State of art in technology for chemical plant protection, research outlook, value of certification, necessity of regular training, participatory design	2x1	INEST
20.11. 2024	6x3 ~18	Machine manufacturers (Wanner Sprühgeräte GmbH, others)	As above	2x1	
5.7. 2024	3	Machine manufacturers (Caffini s.p.a.)	Visitors participated in experiments, discussion of results, analysis of different prototypes	6	INEST
7.3. 2024	~20	Farmers/contractors, extension service personnel, researchers	Overview of technology for chemical plant protection. Problems, state of art in technology,	2.5	SBB, Bring

			research outlook, value of certification, importance of continuous training		
26.5.2023	8	Consorzio Agrario di Bolzano	Presentation of AFILab activities	2.5	
24.11.2023	10	Visit by Reform-Werke to the AFILab laboratory	Presentation and demonstration of the rollover stability platform	6	
12.12.2023	7	Inal (Direzione Provinciale Bolzano)	Presentation and demonstration of the rollover stability platform	2	INAL

Abbreviations of collaborators:

- SBB South Tyrolian Farmer Association
 Bring Mountain farming extension service
 INAL National Italian Work Safety Association
 INEST Interconnected Nord-Est Innovation Ecosystem, PNRR

Some activities were part of training and learning courses as described above. Other activities were part of single demonstrations, guided tours, seminars or study days. Learning activities were tailored to necessities of the agricultural sector in the South Tyrolian context, reflecting on most required tasks and problems, as e.g. vehicle safety issues and plant protection.

The objective of activity 4.2 is seen in the optic of developing pilot courses to Upskilling and Reskilling students for small-scale farming in mountain and hill areas. This activity is closely linked to the field demo activities of 4.1. and builds heavily on previous experiences, partially collected in the first USAGE project.

Exercises refer to different types of agriculture (horticulture and crop production) prevalent in South Tyrol and were held at AFI-Lab at NOI Techpark at UNIBZ.

Achieved Results (5000)

Activity 4.2 enabled us to bring new learners, LLL and regular students, to AFI-Lab. Beside learning, outreach to LLL and interested experts was a main achievement of this activity that increased the high visibility of the AFI-Lab in the region South Tyrol and beyond. The undertaken activities informed actors from the agricultural sector, industry and academic research on possible joint collaborations and services.

Activity 4.2. addressed different topics with diverse pedagogic approaches and used the following instruments and equipment's available in the AFI-Lab:

- Exercise on mobile platform to test machine safety on steep terrains
- Exercise on nozzles and wind channel to conceptualize smart spraying technologies
- Test technology packages for agricultural niche production in mountain areas
- Exercise crop monitoring technologies (ByeLab)
- Analyze transversal activities: Course smart mountain agriculture (Unibz SG)

Objectives were closely related to the other activities within WP 4 of the USAGE NG project:

- 4.4. Farm machinery decision making algorithms
- 4.1. Field-demonstration activities in South Tirol

USAGE NG allowed to conduct and amplify learning activities that took place in the laboratory AFI-Lab, unibz, NOI-Techpark. Hands-on learning on concrete agricultural machines, technologies and instrumental set-ups provides unique possibilities for better understanding. Even more so, when learning is not limited to explanations, but allows for concrete exercises. Exercises in the framework of USAGE NG were used to discuss in detail certain technologies or effects on machinery. Selected exercises were used to maximally integrate students and LLL into relevant problem constellations of agricultural practises in the province South Tyrol and beyond.

The activities helped to attract regular unibz students to further studies at AFILab and possible graduating thesis. Exercises in the lab helped students and LLL to comprehend and conceptualize principle difficulties of typical problems in the agricultural machinery sector.

Innovative pedagogics in AFI-Lab teaching activities were informed by the activities of WP 2:

- * Exercises in the frame of courses, various students.
- * Exercises on stability tests, characteristics of optical sensors
- * Exercises are repeatedly done with groups of regular, visiting or LLL students
- * Exercises on spraying technologies

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- a) Exercise on machine safety and roll-over stability on mobile platform. For this particular task the AFI-Lab possess a unique mobile platform where vehicles up to 10t can be tilted in 360°.
- b) Exercise on spraying nozzles under laboratory and simulated real world conditions. AFI-Lab disposes of a wind channel to simulate real field conditions.
- c) Exercise on crop monitoring in orchards and vineyards, using a prototype vehicle equipped with scanning devices and optical sensors to monitor orchards (ByeLab).
- d) Exercise to measure performance and efficiency of agricultural machines and processes (e.g. cereal production, machine performance) using a set of instruments and sensors.

The held exercises undoubtedly brought participants to better informed decisions in the agro-forestry sector. The exercises are innovative in the sense that they allowed LLL to approach highly relevant topics with a hands-on approach.

3 Results

One result, particularly relevant for the AFI-Lab, was the realization of the unibz Studium Generale course **Introduction to Smart Agriculture Technologies for Mountain Ecosystems** with 3ECTS that was held from 11/2023 to 02/2024. The course contained of 6 innovative, hybrid seminal sessions and 2 innovative exercises in the AFI-Lab.

3.1 Indicators

Quantitative Indicators

▪ Number of learners completing training	362 – 400
▪ Number of smallholder farmers and smallholder farmer organisations reached	8-12
▪ Total hours of lectures	41h
▪ Activities as part of courses, excursions,	2
▪ Number of laboratory exercises done	11

Qualitative Indicators

▪ Perceived relevance to professional practice	high
▪ Pedagogical quality and learner engagement	good - high
▪ Inclusiveness (youth, women, low-qualified learners)	high
▪ Transferability of learning materials	good
▪ Indirect feedback	good
▪ Further request and repetition of events	high
▪ Ex-post evaluation by students and LLL	good-very good
▪ Networking: Interactions with external partners	very high
▪ Satisfaction, sustainability, technical skill level after training etc.	Good-high
▪ High participation	medium- good
▪ High quality of exercises	high
▪ Training materials in person and mobile available	in progress
▪ Positive evaluation of teaching and training offers	high

4 Conclusion

The activity was concluded with very satisfying results.