

Leaf Sampling (Quince Tree Leaf: *Cydonia Oblonga* Miller)

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Abstract – This study was conducted with first-year students of the Laboratory Technology Program at Uşak University, Banaz Vocational School of Higher Education, within the scope of the “Sampling Methods” course. The main aim of the activity was to demonstrate the importance of correct and reliable sampling practices in agricultural and laboratory applications through hands-on leaf sampling from quince (*Cydonia oblonga*) trees. During the practical session, students learned how to select, collect, label, and transport leaf samples properly, in accordance with the principles outlined in ISO/IEC 17025 related to the sampling process. The activity not only enhanced students’ technical skills but also provided a strong connection between theoretical knowledge and real-world laboratory applications. Feedback from participants indicated that the exercise increased their motivation, deepened their understanding of sampling techniques, and improved the overall efficiency of the course. Furthermore, the experience fostered awareness of quality assurance, traceability, and sustainable agricultural practices, aligning with the United Nations Sustainable Development Goals (SDGs)—particularly Goal 4 (Quality Education), Goal 12 (Responsible Consumption and Production), and Goal 15 (Life on Land). In conclusion, this study demonstrated that integrating applied sampling activities into laboratory education significantly improves student engagement and understanding while promoting environmentally responsible practices. Such training contributes to the development of competent, quality-oriented, and sustainability-conscious laboratory professionals prepared to meet the needs of modern scientific and industrial fields.

Keywords – Leaf sampling, ISO 17025, Laboratory Technology Education, Sustainable Development Goals, Quality Assurance.

I. INTRODUCTION

The concept of sustainable development has assumed an increasingly prominent role on the global stage, encompassing a comprehensive integration of environmental, economic, and social dimensions through a holistic approach. It is evident that several of the United Nations Sustainable Development Goals (SDGs) are particularly pertinent in this context. Specifically, Goals 12 (Responsible Consumption and Production), 13 (Climate Action), and 15 (Life on Land) emphasize the efficient use of natural resources, the protection of soil health, and the reduction of environmental impacts. In this context, the implementation of scientifically based monitoring and evaluation methods in agricultural production plays a vital role in achieving sustainability [1].

One of the most significant methods in this regard is leaf sampling, a technique that facilitates precise determination of the nutrient status of a plant and optimization of fertilization strategies. In the context of fruit trees, the judicious timing and execution of leaf sampling studies are of paramount importance for the effective monitoring of plant health, the timely detection of nutritional deficiencies, and the formulation of environmentally responsible production practices.

This study was conducted with first-year students enrolled in the Laboratory Technology Program, as part of the "Sampling Methods Practice" training module. During the course of the activity, leaf samples were collected from quince (*Cydonia oblonga* Mill.) trees, with a particular emphasis on the precise, dependable and standardized implementation of sampling methodologies. Quince (*Cydonia oblonga*) is a fruit species of significant economic and ecological value. It serves as a valuable model for understanding sustainable fruit production practices. The exercise provided students with an opportunity to reinforce their theoretical knowledge through hands-on experience while fostering environmental awareness.

Moreover, the present study is directly related to the requirements of ISO/IEC 17025, particularly with regard to the sampling process [2]. The standard stipulates that sampling should be meticulously planned, thoroughly documented, and traceable to ensure the reliability and validity of analytical results. The implementation of these principles in a practical context resulted in the acquisition of knowledge by the students.

Quince Plant and Its Importance

Quince (*Cydonia oblonga*) is an important fruit species in terms of food, health and industry. Turkey is the world's leading producer of quinces, with an annual production of around 100 thousand tones as of 2000 [3]. Thanks to the vitamins, minerals, phenolic compounds and antioxidants it contains, it strengthens the immune system, supports digestive health and plays a role in the prevention of various chronic diseases [4]-[6]. Therefore, ensuring suitable growing conditions is crucial for quince fruit to achieve high quality and nutritional value [5], [7], [8].

Plant Nutrition and the Importance of Leaf Analysis

Plant growth and yield depend on the adequate uptake of essential nutrients. While both soil and leaf analyses are used to determine plant nutrition status, leaf analysis is considered more reliable as it reflects the plant's actual nutritional status. Leaf analyses can identify deficiencies or excesses of nutrients in the plant, enabling the determination of appropriate fertilization strategies.

Leaf Sampling and Scientific Basis

The accuracy of leaf analyses largely depends on the correct sampling process. This is because the reliability of the analysis results depends on how representative the samples are of the plant. Therefore, a standardized sampling method should be applied, taking into account factors such as sampling time, leaf age, plant region, and environmental conditions [9], [10]. Correct sampling increases the validity of the analysis results and prevents misinterpretation.

Purpose of the Practical Work

This study is a practical training activity carried out with first-year students of the Laboratory Technology Program. The purpose of the study is to introduce students to plant sampling methods, teach them the correct sample collection techniques for leaf analysis, and emphasize the importance of this practice in agricultural production. Thus, students have the opportunity to consolidate their theoretical knowledge and develop their skills in preparing samples suitable for laboratory analysis.

Sampling Principles within the Scope of ISO 17025

The ISO/IEC 17025 standard is an international quality standard that determines the technical competence of laboratories and the reliability of the results obtained. Within the scope of this standard, the sampling process is also considered a critical stage that directly affects the quality of measurement and analysis results.

According to ISO 17025, the sampling process must be planned, traceable, documented, and carried out in accordance with standard procedures. The representativeness, homogeneity and protection of samples from contamination are fundamental requirements for reliable analysis results. Therefore, acting in accordance with ISO 17025 principles in leaf sampling studies is important from both an educational and analytical perspective.

II. MATERIALS AND METHOD

Purpose and Scope of the Study

This study was conducted as part of the 'Sampling Methods' course for first-year laboratory technology students to develop their ability to correctly sample plant materials. The study took place in the garden of Uşak University Banaz Vocational School, where a leaf sampling exercise was performed on quince (*Cydonia oblonga*) plants. During the exercise, the sampling criteria and their impact on the analysis process were demonstrated.

Application area and conditions

The leaf sampling study was conducted in the garden where the quince trees are located. Weather conditions, sampling time and the phenological stage of the plants were taken into account during the study. Sampling was carried out in the morning under sunny, dry conditions. These conditions aim to increase the accuracy of the analysis results by preventing the accumulation of water or dust on the leaf surface.

Materials and equipment used

The following materials and equipment were used during sampling: Paper bags (for transporting samples). Labels and a pen for coding samples. Scissors or a knife for taking leaves without damaging them. Cold chain or ice-packed box for short-term storage of samples. A notebook for recording sampling information.

Sampling method

When collecting leaf samples from quince trees, leaves of the same developmental stage that were disease-free, sun-exposed and of an average size were selected from each tree. Leaves collected from all four directions (north, south, east and west) were combined to form a composite sample. Each sample was properly labelled and transported to the laboratory.



Collection of leaves from the middle canopy of healthy branches



Washing of sampled leaves with distilled water to remove surface contaminants



Drying of clean leaves in a laboratory oven at 70 °C for 24 h prior to analysis.

Fig. 1 Stepwise illustration of the leaf sampling process from quince (*Cydonia oblonga*) trees.

Pre-laboratory procedures

The leaf samples were gently washed with pure water in the laboratory to remove dust and dirt. They were then dried with blotting paper and dried in an oven at 70 degrees Celsius for 24 hours. After drying, the samples were ground in a mortar to prepare them.

III. RESULTS

A total of 29 students from the 1st year of the Laboratory Technology Programme participated in this study. Of these, 25 were female and 4 were male students. The application was carried out with the active participation of all students, in the form of a study of leaf samples from the quince (*Cydonia oblonga*) plant.

Observations and evaluations

During the application process, students successfully completed the stages of collecting leaves from the sample area, labelling, bagging and preparing the samples for analysis. The majority of students paid attention to the representativeness of the sample, the sampling standards, hygiene and safety regulations during the sampling process.

The following observations were made during the leaf sampling process: Students correctly determined the sampling time and leaf selection. Some students made minor errors during the labelling stage, which were discussed and corrected at the end of the application. All students have complied with health and safety and hygiene regulations. ISO 17025 standards have been implemented to ensure the reliability and traceability of sampling.

Learning Outcomes

At the end of the application, students:

could define the rules of plant sampling;

explain how correct leaf sampling affects the accuracy of analysis;

They will have understood the relationship between the sampling process and quality management within the scope of ISO 17025. Results should be clear and concise. The most important features and trends in the results should be described but should not interpreted in detail.

IV. DISCUSSION

This study was implemented with first-year students of the Laboratory Technology Program at Uşak University, Banaz Vocational School of Higher Education, Department of Chemistry and Chemical Processing Technologies, as part of the “Sampling Methods” course. The primary goal was to enhance students’ understanding of sampling principles through experiential learning. By conducting leaf sampling from quince (*Cydonia oblonga* Mill.) trees, students were able to apply theoretical knowledge in a real-world context, bridging the gap between classroom instruction and field practice.

During the activity, participants applied correct techniques for selecting, labelling, and transporting leaf samples under appropriate conditions. This practical engagement helped them internalize the fundamental aspects of the sampling process, while simultaneously reinforcing the quality requirements of ISO/IEC 17025 within an educational framework. Such integration of quality-based practices into field activities strengthens students’ appreciation of the link between proper sampling and the reliability of analytical outcomes.

Feedback collected after the activity indicated that the majority of students found the practical work to be highly effective in improving their comprehension and motivation. They reported that hands-on participation not only made the lessons more engaging and efficient but also facilitated deeper and more permanent learning. Furthermore, participants emphasized that field-based exercises enhance professional skills by connecting theoretical concepts to real laboratory and environmental applications. The fact that this activity was highlighted on the university’s official website further demonstrates its educational and institutional value.

Overall, the findings support the view that practice-oriented learning significantly contributes to laboratory technology education. By actively involving students in sampling applications, such methods foster both conceptual understanding and environmental awareness. Moreover, linking agricultural sampling with laboratory quality standards promotes sustainable and internationally aligned professional competencies, preparing students to meet global expectations in analytical sciences and environmental stewardship.

V. CONCLUSION

This study demonstrated that integrating applied fieldwork with quality assurance principles provides an effective educational model for laboratory technology students. Through active participation in a real sampling process, students gained practical experience that enhanced their technical skills, deepened their understanding of quality-oriented laboratory practices, and increased their awareness of sustainability principles.

It is recommended that future activities expand the scope of plant species and sampling periods, and include subsequent stages such as laboratory analysis and data interpretation. This comprehensive approach would allow students to experience the entire workflow—from field collection to analytical evaluation—thereby reinforcing both technical and critical thinking skills. Additionally, developing collaborations with local producers could strengthen university–community partnerships and support the United Nations Sustainable Development Goals (SDGs) related to quality education (SDG 4) and responsible production (SDG 12).

In conclusion, the study successfully combined experiential learning, quality assurance, and sustainability, offering a valuable model for enhancing both the technical proficiency and the environmental consciousness of future laboratory professionals.

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