Exploration of Typical Case Teaching Model Driven by Science and Technology Backyard
Taking the Diagnosis and Prevention of Main Diseases of Qingshuping Yam as an Example

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ABSTRACT
The case teaching method involves typicalizing real-life scenarios to create cases for students to think and analyze, centered around specific training objectives. It also cultivates students' abilities to identify, analyze, and solve problems, as well as their innovative capabilities. The case teaching method serves as a crucial teaching model for cultivating high-level applied professional degree graduate students. This study employs typical case teaching driven by "science and technology backyard", leveraging the collaborative mechanism of industry-education integration to transform industry needs into teaching resources, effectively enhancing resource utilization and the practical abilities and technological innovation levels of graduate students in the field of plant protection.

Keywords: *Science and technology backyard, Case teaching method, Yam disease, Teaching model.*

1. INTRODUCTION

The Master of Agriculture degree primarily aims to cultivate high-level applied and interdisciplinary talents for agricultural technology promotion and rural development, in order to better meet the urgent needs of China's agricultural modernization and rural development for high-level specialized talents [1]. The science and technology backyard closely integrates graduate student training with agricultural production practices, achieving a close integration of teaching and education, fields and classrooms, theory and practice, scientific research and promotion, innovation and service [2].

"Integrated Pest Management for Plants" is a core course for graduate students pursuing a full-time Master's degree in Resource Utilization and Plant Protection at Hunan University of Humanities, Science and Technology. The course primarily focuses on learning and teaching about the occurrence of crop diseases, pests, and weed infestations in Hunan Province, as well as the integrated prevention and control techniques for these issues. Through studying this course, students will gain an understanding of the occurrence, harm, and integrated prevention and control principles and techniques of crop pests in agricultural production. They will also comprehend the current development overview of pesticides globally and in China, and grasp the functions, characteristics, and future development directions of insecticides, fungicides, and herbicides [3].

The case teaching method is a teaching approach that focuses on specific training objectives, typicalizes real-life scenarios, and forms cases for students to think and analyze, aiming to

enhance their analytical and problem-solving abilities [4]. The diagnosis and prevention of major diseases in Qingshuping yam is one of the special cases in the graduate course "Integrated Prevention and Control of Plant Pests" in the field of Resource Utilization and Plant Protection at Hunan University of Humanities, Science and Technology. It aims to cultivate and guide graduate students to integrate course learning with scientific research, promoting their independent thinking, problem-finding, analysis, and problem-solving abilities. This study aims to systematically elaborate on the construction methods and practical effectiveness of the technology small-scale case library, providing operational and replicable experience for the integration of industry and education in the field of plant protection. It can not only help solve the industrial dilemma of "difficulty in technology implementation" but also bring new ideas to the reform of the cultivation model for agricultural professional degree graduate students.

2. SOURCE OF CASE LIBRARY

2.1 Case Source

The case sources and selection of this research case library strictly follow the orientation of industry-education integration. It combines three aspects: the severe occurrence of yam diseases in Qingshuping Town, Shuangfeng County, which restricts the development of the agricultural industry in Shuangfeng; the Hunan Provincial Shuangfeng Yam Technology Backyard and the provincial and ministerial-level scientific research project (2025JJ70341) of team members. Especially, with the adjustment of agricultural industrial structure and the continuous increase in market demand in Qingshuping Town, Shuangfeng County, the planting area of yams in Qingshuping, Shuangfeng has expanded year by year. Plant protection disease issues such as root rot and anthracnose have become increasingly prominent. Growers face problems such as inaccurate identification and diagnosis of yam diseases, irregular planting management, and unreasonable pesticide use. The course instructors are jointly composed of university doctoral students, technical personnel from the municipal plant protection station, and base leaders. They strictly screen and review the teaching topics, considering technical feasibility (matching degree of experimental conditions), teaching adaptability (operability for students), and industry promotion value (mainly considering economic benefits). Secondly, the teaching team is organized to demonstrate the technical normativity, scientificity, and operability of the cases. Finally, teaching trials are conducted to verify the effectiveness of the course teaching [5].

2.2 Case Library Module Design

The case library module adopts a hierarchical modular architecture of "theory-experiment-practice". The theoretical module is designed to focus on the diagnostic points, pathogen status and characteristics, occurrence patterns and prevalence, and integrated control of yam root rot and yam anthracnose. The theoretical extension focuses on analyzing the pathogenic mechanism of Fusarium root rot. The experimental module selects disease surveys and laboratory morphological observation; the comprehensive practice involves conducting research on yam planting and cultivation techniques, as well as integrated pest and weed control at the yam base of Shuangfeng Nongfengxiang Agricultural Development Co., Ltd. (“Table 1”)

Table 1. Module design for diagnosis and prevention of major diseases of Qingshuping yam

Module	Main content	Planned time/min	Teaching format
Course Introduction	Why are soil-borne diseases difficult to control?	5	Discussion
Theory 1: Yam root rot disease	Diagnostic points of yam root rot disease	5	Classroom teaching + discussion
	Classification and morphological characteristics of pathogenic bacteria	4	
	Occurrence patterns and disease epidemics	5	
	Comprehensive prevention and control	6	
Theory 2: Yam Anthracnose	Diagnostic points of anthracnose disease in yam	5	Classroom teaching + discussion
	Classification and morphological characteristics of pathogenic bacteria	4	
	Occurrence patterns and disease epidemics	5	
	Comprehensive prevention and control	6	
Theoretical extension	Analysis of the pathogenic mechanism of Fusarium	25	Classroom lecture
Experiment 1	Disease survey of yam root rot	20	Choose one from three
Experiment 2	Disease investigation of anthracnose on yam		
Experiment 3	Observation of morphological characteristics of Fusarium		
Practice	Chinese yam cultivation techniques Prevention and control techniques for pests, diseases, and weeds in yam cultivation	300	Yam Base in Qingshuping Town

3. TYPICAL CASES OF DIAGNOSIS AND PREVENTION OF MAIN DISEASES OF QINGSHUPING YAM

3.1 Teaching Approach Based on Typical Cases

The teaching of the course "Integrated Pest Management for Plants" strives to combine professional knowledge and practical abilities in the field of integrated pest management for plants, fully leveraging the leading role of students in learning. Through the "simulated practical" training in case studies, students are cultivated to be diligent in thinking, analyze specific issues specifically, draw inferences about other cases from one instance, and solve problems innovatively. In practical training, students are further encouraged to identify problems in the fields and agricultural production bases, develop relevant solutions and strategies, and conduct research and innovation on applied topics or practical issues such as soil and fertilizer, plant protection, and agricultural ecological environment, focusing on the "agriculture, rural areas, and farmers" issues. They are encouraged to comprehensively utilize scientific theories, methods, and technical means for innovative exploration and practice, ultimately cultivating applied and composite high-level vocational skills talents who "understand theory, are proficient in technology, and can apply" for relevant departments, industries, enterprises, institutions, and new agricultural business entities in the fields of soil and fertilizer and plant protection

3.2 Collection and Organization of Typical Cases

Teachers collect case materials such as videos, photos, and phone records through various channels, including serving as municipal agricultural science and technology special correspondents, participating in yam cultivation and planting in small science and technology institutes, communicating with growers, and leading student internships. They gather typical photos of yam root rot and anthracnose, as well as working photos of the planting process and prevention measures. The typical symptom photos are brought back to the laboratory for pathogen isolation, identification, and other procedural data. These materials are then organized into teaching casebooks, which is a crucial step in implementing case-based teaching.

3.3 "Case Five-step Method" Teaching Model

Students Grouping Before Class Prior to the commencement of the course, based on the equipment conditions of the smart classroom, students are required to freely combine according to their interests, hobbies, etc., and will be divided into three learning and discussion groups.

Before class, learning tasks and online discussion questions are released. Students are required to respond with their individual views and group comprehensive discussion results online for the preview and discussion topics released before class. All discussion results will be compared among groups on the multimedia during class, followed by teacher comments, explanations, and evaluations, highlighting the key points of the lesson. Homework released before class includes: (1) Why is the yam planting area in Qingshuping limited to the vicinity of Wuxing Village in Qingshuping Town? (2) Cultivation techniques for Qingshuping yam. (3) Why are soil-borne diseases difficult to prevent and control?

Teachers introduce case scenarios and diagnose typical cases. Teachers can use teacher-designed problem cases as a guide to introduce teaching under the contextualized "plant doctor" scenario, allowing students to analyze real-time information about yam cultivation and planting in an immersive environment. Through analyzing, discussing, and commenting as "plant doctors," students can acquire relevant knowledge. For example, teachers can combine pictures and videos of yam root rot disease (anthracnose) from the case library, utilize multimedia teaching videos and online resources to attract students' attention and interest, enabling them to quickly enter the scenario of learning new knowledge. First, teachers can play videos of production case scenarios and production pictures of the base, recreating the harm of "yam root rot disease" in the classroom. Students discuss how to quickly diagnose the key symptoms of yam root rot disease. (2) The instructor explains the taxonomic status and morphological characteristics of the pathogen responsible for root rot disease (anthracnose). (3) Group discussions focus on the occurrence patterns and disease prevalence of root rot, how the disease spreads, where it overwinters, how it is initially infected, and how it is re-infected. (4) Considering the occurrence patterns and disease prevalence characteristics of yam root rot, groups discuss how to comprehensively prevent and control yam diseases. (5) In the theoretical extension section, teachers download relevant literature from The American Phytopathological Society (APS) on Fusarium topics, and explain the pathogenic mechanism of Fusarium.

In classroom discussion, or the case study on yam root rot disease, combined with the photos and videos of yam anthracnose disease taken and played, students will discuss in groups the diagnostic points, occurrence patterns and prevalence, as well as comprehensive prevention and control measures of yam anthracnose disease. They can connect with the base manager or staff from the municipal plant protection and inspection station on-site to discuss and exchange opinions, and prescribe a treatment "prescription" for yam anthracnose disease.

The last step is case summary, the instructor summarizes the research ideas, methods, and applications in production of the integrated prevention and control technology for root rot/anthracnose of yam in Qingshuping, and condenses the key issues affecting the prevention and control effect in the case, such as the key factors leading to the occurrence and disaster of harmful organisms, and the key reasons for the success or failure of prevention and control of harmful organisms. Emphasis is placed on the importance of independent thinking, in-depth research, drawing analogies, and flexible application based on solid theoretical knowledge in case study.

3.4 Experimental Demonstration Session

Leveraging the laboratory conditions and resources of Hunan University of Humanities, Science and Technology, the authors conducted disease surveys and observations of pathogen morphological characteristics. Through the implementation of the scientific research project (2025JJ70341), the authors utilized field survey data and strains preserved in the laboratory to carry out experimental demonstrations.

3.5 Comprehensive Practical Link

The practical teaching segment primarily involves guiding students to visit and conduct research at the Hunan Shuangfeng Yam Technology Courtyard and the planting base of Shuangfeng County Nongfengxiang Modern Agricultural Comprehensive Development Co., Ltd. Students are led to understand the cultivation process of yams, the main types of pests and diseases, packaging and sales, and other production

techniques. By combining the principles and methods of comprehensive prevention and control measures learned, students formulate prevention and control plans. This segment focuses on cultivating students' abilities to innovate and independently solve production problems. (“Figure 1”)

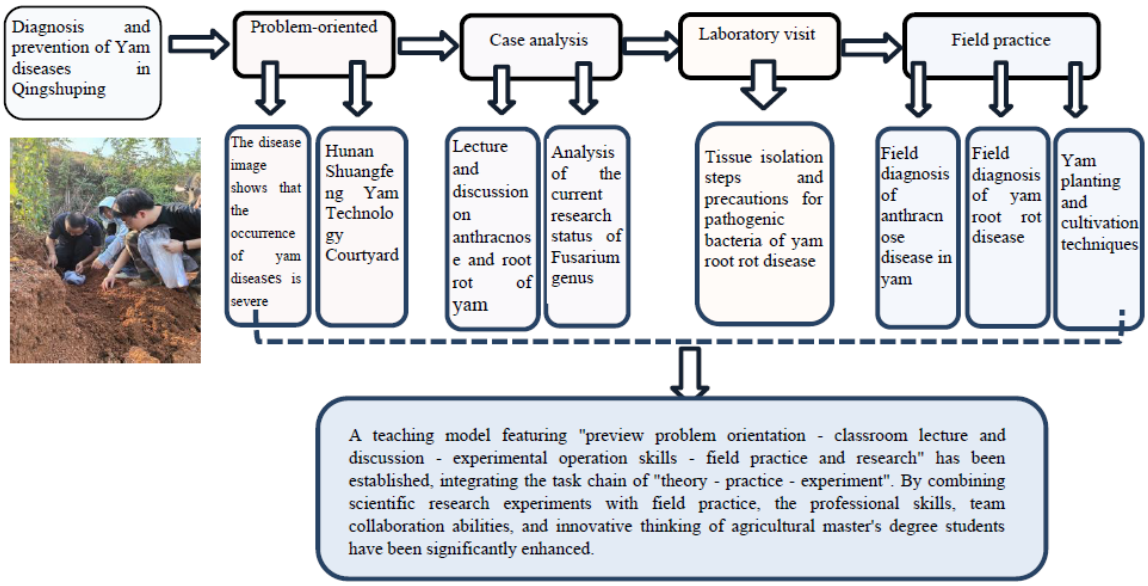

Figure 1 Key points during the implementation of teaching cases.

4. CASE TEACHING DRIVEN BY SCIENCE AND TECHNOLOGY BACKYARD

4.1 Cultivation Model for Master of Agriculture in Science and Technology Backyard

It is necessary to establish a deep integration of "government, industry, academia, research, and application" in the cultivation model for postgraduate innovative talents. Through the deep integration of "theory and practice, knowledge and ability, in-class and out-of-class, major and career, school and enterprise", it can achieve "platformization of theoretical teaching, corporatization of practical teaching, authenticity of practical tasks, comprehensive quality cultivation, and diversification of teaching staff". Following the cultivation form of "school-enterprise integration and learning-application combination", it can fully serve the construction of the national innovation system, serve the national innovation-driven development strategy, and serve the rural development strategy. At the same time, it is necessary to establish a team of high-quality postgraduate supervisors and practical instructors with advanced teaching concepts, solid theoretical knowledge, excellent professional skills, and a reasonable structure [6].

4.2 The Innovativeness of Case Teaching Driven by Science and Technology Backyard

In terms of organizational structure, the innovative application of "dual mentors" is adopted, namely, academic mentors from within the university and mentors from enterprises and industries outside the university, to ensure that research topics possess both academic value and align with industry needs. In terms of operational mechanism, the "double helix drive" model is employed: on the one hand, the "industry problem list" is utilized to gather enterprise needs, and on the other hand, a "technology achievement supermarket" is constructed to promote the transformation of achievements. In terms of case teaching content, instructors fully integrate scientific research projects carried out in the science and technology small courtyard into the course content, such as the identification of pathogenic bacteria causing yam root rot, indoor chemical screening, screening and evaluation of biological and chemical fungicides, and research on the prevention and control mechanism of biological

control bacteria. Combining theoretical knowledge with practical production enhances the forward-looking, progressiveness, and applicability of teaching content. In practical teaching, graduate students visit the front line of agricultural production, conduct scientific research oriented towards practical problems, and maintain close contact with farmers, thereby improving their practical abilities and service awareness.

In the process of teaching reform for the Master of Agriculture program, it is necessary to emphasize the strengthening of professional and agricultural knowledge, while focusing on cultivating students' abilities and thinking. There is a must to fully leverage the role of the small-scale scientific and technological practice skill training base in practice, disseminate industry and industrial knowledge, and enhance students' ability to solve practical production problems. It is also necessary to have established a five-in-one knowledge framework, encompassing "basic knowledge, professional knowledge, agricultural knowledge, industry knowledge, and industrial knowledge", to achieve a teaching reform that integrates theory and practice, thereby comprehensively enhancing the quality of cultivating high-level, composite applied talents in agriculture [7].

5. CONCLUSION

Based on the cultivation philosophy of high-level talents for agricultural master's degree holders, which emphasizes "broad disciplinary knowledge, strong practical skills, and practical service to agriculture, rural areas, and farmers," the "science and technology backyard+" agricultural master's talent cultivation model is constructed, meeting the requirements of a new knowledge system, new disciplinary organization, and new talent cultivation model for the construction of new agricultural sciences [8]. This study employs typical case teaching driven by "science and technology backyard", leveraging the collaborative mechanism of industry-education integration to transform industry needs into teaching resources, effectively enhancing resource utilization and the practical abilities and technological innovation levels of graduate students in the field of plant protection. Future research can be deepened in three aspects: the first is expanding the coverage of the case library to include more integrated pest and disease control technologies for crops in Hunan Province. The second is fully integrating scientific research achievements and social services into graduate teaching classes to enhance students' enthusiasm and initiative, and to increase the enthusiasm of enterprises to participate in case development. The third is deeply exploring the integration of virtual simulation technology and case teaching to improve the accessibility of teaching resources.

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