Article

Research on the Cultivation of Innovative Talents and Practical Pathways in Agricultural Universities under the "Double First-Class" Initiative--A Case Study of the "Yuxin" Practice Team of Henan Agricultural University

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Abstract: The "Double First-Class" initiative prioritizes the cultivation of high-caliber innovative talents. Agricultural universities are entrusted with the contemporary mission of supporting rural revitalization and ensuring food security. To address challenges such as the misalignment between talent cultivation and industrial demands, as well as incomplete practical training systems in certain agricultural universities, this study examines the "Yuxin" practice team of Henan Agricultural University as a case study. Through case study, literature review, and inductive analysis methods, it systematically explores the team's integrated four-pronged approach to cultivating innovative talents, characterized by "Value Guidance-Integration of Research and Competition-Grounding Fundamentals in Practice-Empowerment through Inheritance." The study reveals that the team's success stems from an educational model centered on a "Competition-Research-Practice" cycle. This model emphasizes engagement with authentic agricultural challenges, reinforced ideological guidance, ability development through real-world projects, skill enhancement on comprehensive practical platforms, and a culture of peer mentorship that ensures the continuity of innovation. As shown in Table 1, this approach has produced notable outcomes in academic innovation, competition achievements, talent development, and social service. The findings offer practical references and theoretical insights for agricultural universities under the "Double First-Class" initiative, providing guidance to overcome challenges in talent cultivation and to construct distinctive and effective educational systems.

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1. Introduction

The "Double First-Class" initiative represents a major strategic decision by the Chinese government, designed to advance the connotative development of China's higher education system. Its primary mission is to cultivate high-caliber innovative talents capable of supporting national strategies and driving sustainable socio-economic development. As a fundamental pillar of the national economy, agriculture has received increasing policy emphasis. The "Plan for Accelerating the Construction of an Agricultural Power (2024-2035)" highlights the importance of "strengthening the talent team for building an agricultural power," while the 2025 No. 1 Central Document reaffirmed support for platforms such as the Science and Technology Backyards, encouraging them to "take root in the fields and cultivate new-type agricultural talents." These policy

directions elevate the cultivation of innovative agricultural talent to a matter of national strategy.

Chinese agriculture is currently undergoing a critical transition from traditional to modern practices, facing pressing challenges such as soil degradation, limited ecological resilience, and the urgent need to enhance grain production capacity. Addressing these challenges requires a new type of compound talent-individuals who not only master advanced agricultural technologies but also possess strong practical skills, innovative thinking, and a deep commitment to serving agriculture, rural communities, and farmers [1].

Henan Agricultural University, a key provincial agricultural institution, has integrated talent cultivation into its "Double First-Class" development agenda. A prominent example is the "Yuxin" practice team from its College of Agronomy. Over more than a decade, the team has concentrated on addressing soil remediation challenges in the Huang-Huai-Hai region and has systematically developed a distinctive model for nurturing innovative talents. To date, the team has trained over a hundred students across undergraduate, master's, and doctoral programs, with students specializing in Master of Agriculture and Seed Industry comprising 42% of the cohort. These students play pivotal roles in technology extension, achievement transformation, and field services.

The "Yuxin" practice team has achieved significant accomplishments, including multiple national awards such as the gold medal in the China International College Students Innovation Competition. Additionally, the team has published 31 high-level academic papers, demonstrating the effectiveness of its practice-embedded training model. By examining the "Yuxin" practice team as a case study, this paper analyzes the core components and internal logic of its talent cultivation mechanism, aiming to provide practical pathways for other agricultural universities to enhance students' innovative capacities and optimize their talent development systems, thereby contributing to China's strategic goal of building a strong agricultural sector [2].

2. Analysis of the Practical Pathway for Cultivating Innovative Talents in the “Yuxin” Practice Team

Guided by the fundamental principle of "Fostering Virtue through Education" and oriented toward the concept of "Comprehensive Education," the "Yuxin" practice team has established a multi-dimensional driving mechanism. This system is propelled by high-level disciplinary competitions, anchored in cutting-edge scientific research, and deeply embedded in social service practice. Such an integrated approach ensures that talent cultivation is not only theoretically rigorous but also practically relevant, effectively bridging the gap between academic knowledge and real-world agricultural challenges. As a result, students are nurtured into well-rounded innovators with both professional competence and social responsibility.

2.1. Focusing on Agricultural Pain Points, Strengthening Value Guidance

The Huang-Huai-Hai region's wheat-corn rotation system suffers from over-reliance on simplistic crop varieties and long-term fertilizer overuse, resulting in severe soil microbial imbalance and poor ecosystem resilience. Frequent meteorological disasters further reduce crop stress resistance, limiting stable high yields. To tackle this complex problem, the "Yuxin" practice team looked beyond traditional agricultural approaches, drawing interdisciplinary inspiration from the medical concept of synbiotics. They recognized a compelling analogy: "Soil health is fundamentally similar to human gut health; only with a balanced and thriving micro-environment can crops achieve optimal growth and productivity."

This insight led students to propose the innovative approach of "using beneficial bacteria to revitalize soil, and employing specific metabolites to nourish and sustain those bacteria." Guided by this principle, the team developed a method combining targeted

probiotics (beneficial microbial strains) with prebiotics (nutrients supporting these microbes). Through rigorous experimentation and field validation, they successfully established a novel "Soil Synbiotics" technology system, which functions as both a diagnostic and therapeutic tool for degraded soils. This system allows the team to prescribe targeted microbial communities to restore soil health and functionality [3].

Importantly, the development of this technology was closely integrated with the team's talent cultivation objectives. From identifying field problems to breakthrough research and subsequent social service through technology demonstration, students experienced an immersive educational scenario. This hands-on journey enabled them to directly observe the urgent demands of modern agriculture and the expectations of farmers, fostering a deep-seated commitment to agriculture, rural areas, and rural communities, and continuously shaping the mission and responsibility of a new generation of agriculturists [4].

2.2. Integrating Research and Competition, Creating a Progressive Training Chain

For the "Yuxin" practice team, competitions were not goals in themselves but platforms for demonstrating the outcomes of tangible research projects, such as the "microbial consortia synergy" initiative. This project offered students a full-cycle scientific research experience-from precise laboratory combinations of microbial strains and metabolites to technology implementation in real field conditions. Through this process, students cultivated rigorous scientific attitudes and the ability to address complex problems [5].

To bridge the gap between research and practical application, the team leveraged platforms like the "Science and Technology Backyard," bringing their technology directly to farmers' fields. Students engaged in face-to-face promotion and dialogue, translating scientific concepts into practical benefits. The inclusion of international students further enhanced cross-cultural communication skills and global perspectives, enabling students to gain a ground-level understanding of national agricultural realities and internalize a strong sense of social responsibility.

The team strategically used prestigious competitions, such as the China International College Students' Innovation Competition, as phased goals to intensify learning. These competitions acted as catalysts, motivating students to engage in systematic knowledge integration and capability enhancement. Preparation involved anticipating hundreds of potential questions and refining presentations through repeated rehearsals, which strengthened logical thinking, adaptability under pressure, and teamwork. Consequently, students participated in the entire innovation chain-from theoretical conception and experimental validation to final technology application-thereby honing comprehensive research skills and the capacity for genuine breakthroughs [6].

2.3. Building on Practice, Constructing an All-Scenario Practical System

Relying on practical bases such as the Xuchang Wheat-Corn Science and Technology Backyard, the "Yuxin" practice team immersed students in authentic agricultural environments. Students participated in all stages, from crop planting and management to soil monitoring and data collection, bridging abstract theory and practical reality.

Achieving the "precise combination" of probiotics and prebiotics presented substantial challenges. With a gram of soil containing hundreds of millions to tens of billions of microbial individuals, identifying synergistic combinations was akin to finding a needle in a haystack. One team member described it as "finding the exclusive rations for beneficial microbes; the match must be precise to trigger the desired restorative effect."

This complexity required clear division of labor and perseverance. Some members focused on overarching technical direction and project management, coordinating progress and engaging in in-depth lab discussions late into the night. Others served as "field specialists," collecting and verifying data under extreme heat to ensure laboratory

findings held in real-world conditions. International student Reda evolved from overcoming initial language barriers to become a "cross-cultural bridge," supporting technology promotion to broader audiences. Setbacks, such as formulas that worked in the lab but failed in the field, were frequent, but these challenges motivated the team to refine hypotheses, strengthen scientific thinking, and gain invaluable practical experience. Through this iterative process, students developed the resilience and problem-solving skills essential for innovation [7].

2.4. Empowerment through Inheritance, Sustaining the Spark of Innovation

The "Yuxin" team adheres to the "Comprehensive Education" philosophy, integrating education on ideals and values, scientific research capability development, and social responsibility throughout the talent cultivation process. This holistic approach ensures that students develop technical expertise alongside a strong moral compass and societal awareness. Practical platforms, such as the "Science and Technology Backyard," provide environments where students identify real-world problems, enhance abilities through rigorous research, and engage directly in social service.

To ensure continuity, the team established a multi-tiered mentorship system in which doctoral students guide master's students, and master's students mentor undergraduates. This structure ensures the transfer of knowledge, practical skills, and core team culture across cohorts. The diverse backgrounds of students-including undergraduates, master's and PhD candidates, and international members-create a vibrant "learning community" in which the integration of different perspectives consistently stimulates innovation.

A concrete example occurred in summer 2023, when Master of Agriculture and Seed Industry students organized a "Free Soil Sample Testing for Farmers" initiative, guiding undergraduates through the process. They also collaborated with township extension agents to implement the "Soil Improvement Technology Village Entry and Household Access" program. This practice achieved multi-faceted synergy: it facilitated master's student mentorship, integrated theoretical knowledge with practical application, and strengthened connections between the academic campus and grassroots communities. Simultaneously, it provided valuable feedback for refining the professional degree cultivation model for the Master of Agriculture and Seed Industry program.

3. Significant Educational Outcomes and Experiential Insights from the “Yuxin” Practice Team

The cultivation model of the "Yuxin" practice team has achieved remarkable results in talent development. Its evaluation system extends beyond single papers or awards, demonstrating both diversification and comprehensiveness.

3.1. Cultivation Outcomes

3.1.1. Abundant Academic Innovation Achievements

By establishing a cross-grade research echelon encompassing undergraduate, master's, and doctoral students, the practice team has created a pipeline that allows undergraduates to engage deeply in high-level academic research. This innovative structure forms a comprehensive research training chain, guiding students through the entire process from basic data collection, experimental protocol optimization, to paper writing and publication. This systematic approach dismantles traditional academic barriers and enables students at different levels to contribute complementary expertise.

The effectiveness of this model is evident in its publication outcomes: cumulatively, 31 students across undergraduate, master's, and doctoral levels have published academic papers as first authors. These include eight papers in CAS Q1 journals, featuring authoritative agricultural publications such as Soil Biology & Biochemistry and Field Crops Research, fifteen papers in CAS Q2 journals, and eight papers in core journals. Notably, the research topics consistently address practical agricultural challenges in the

Huang-Huai-Hai region, particularly soil remediation and sustainable high crop yield strategies, achieving precise alignment between scientific innovation and industrial demand, and producing dual benefits in talent cultivation and agricultural development.

3.1.2. Outstanding Disciplinary Competition Performance

The "Yuxin" practice team has cultivated a virtuous cycle by integrating core research projects with high-level academic competitions, generating a dynamic of "promoting research through competition and creating competition through research." Competition preparation is treated as an intensive, focused phase of the research process rather than a separate activity.

During national finals roadshows, where precision and impact are critical, training was meticulous: presentation timing was rehearsed to the second, and students prepared for over 300 potential Q&A questions, developing multiple roadshow scripts for adaptability. For the provincial "Red Travel" track, which emphasizes social impact and grassroots engagement, the team tailored the narrative to highlight their real-world soil improvement assistance in Xihua County, Zhoukou City, thereby combining rigorous academic content with compelling social significance.

This disciplined and adaptive approach yielded historic results. The flagship project, Synbiotics·Cultivating the Future - Synergistic Microbe-Metabolite Collaboration Composing a New Chapter for Fertile Farmland, secured the national gold award, marking the first gold award in the prestigious graduate creative group, Main Track, for Henan Agricultural University. Additionally, in 2023 alone, the team claimed one provincial "Red Travel" championship, one provincial "Challenge Cup" special prize, and two gold awards, achieving unprecedented breakthroughs across diverse competitive platforms.

3.1.3. Excellent Personal Growth and Honors

The team's cultivation model has demonstrated remarkable effectiveness in fostering comprehensive student development, encompassing knowledge acquisition, practical ability, and personal growth. This is reflected in 33 instances of provincial-level or higher individual honors across undergraduate and specialized master's programs.

At the undergraduate level, 15 students received prestigious distinctions, such as "Outstanding Graduate of Henan Province" and "Three Good Students of Henan Province." A notable example is Jiang Yu, class of 2023, who earned the "National College Student of the Year Nomination Award" for his dedication to field-based research, a story featured by Henan Daily.

At the Master of Agriculture and Seed Industry level, eight students received distinguished accolades, including "Henan Province Postgraduate Innovation Star" and "Colorful Henan People." Master's student Long Haochi was recognized as the "6th Most Beautiful College Student" for his contributions in the Science and Technology Backyard, leading farmers to improve over 2,000 acres of soil and achieving a collective income increase exceeding 400,000 RMB. These honors across academic stages underscore the model's success in cultivating agriculturists who are both academically competent and committed to serving rural communities.

3.1.4. Prominent Social Service Value

Guided by the mission of "serving agriculture, rural areas, and farmers," the "Yuxin" practice team has systematically utilized platforms such as Science and Technology Backyards and enterprise cooperation bases to implement impactful social activities. These initiatives bridge academic research and practical application, primarily through targeted technology extension services, practical skill training for farmers, and public welfare programs.

The scale of impact is substantial: cumulative outreach exceeds 50,000 farmers, with techniques applied to over 20,000 acres of cultivated land. These efforts have generated significant economic benefits for rural communities, contributing to a collective farmer income increase exceeding ten million RMB. In recognition of its contributions, the team has received prestigious collective honors, including the National Outstanding Team for Summer Social Practice of "Culture, Technology, and Health" and the "May Fourth Youth Medal Collective" from Henan Agricultural University, solidifying its model of integrating academic pursuit with social responsibility.

3.2. Experiential Insights

3.2.1. Adhere to the Core of Demand Orientation

In cultivating innovative talents, universities must eliminate barriers between classrooms, laboratories, and social practice. Engagement with real agricultural challenges and authentic industrial problems is crucial. Enabling students to "learn by doing" and "innovate through research" is key to internalizing knowledge and enhancing capabilities.

3.2.2. Build Platforms Integrating Research, Competition, and Practice

Disciplinary competitions not only evaluate learning outcomes but also provide goal-oriented, high-pressure environments that facilitate comprehensive improvement in knowledge, skills, and professional disposition, accelerating the development of students' overall competencies.

3.2.3. Ensure the Foundation of Value Guidance

Talent cultivation extends beyond skill transmission to the shaping of values and social responsibility. Universities should consistently integrate the cultivation of the "agriculture, rural areas, and rural people" ethos throughout the educational process, guiding students to aspire toward serving the construction of a strong agricultural sector and ensuring the proper orientation of talent development.

4. Conclusion

Guided by the "Double First-Class" initiative, the "Yuxin" practice team at Henan Agricultural University has developed and refined an innovative talent cultivation pathway centered on a "Competition-Research-Practice" closed-loop model, underpinned by cross-grade mentorship and cross-cultural integration. This approach effectively bridges the longstanding gap between theoretical instruction and practical application in agricultural education. By systematically integrating rigorous scientific research, high-level competitions, and immersive field practice, the team has successfully cultivated "New Agriculturists" who possess not only solid professional knowledge and advanced technical skills but also a strong sense of social responsibility and outstanding innovative capabilities.

The team's experience demonstrates that cultivating high-level agricultural talent requires more than classroom instruction; it demands immersive, real-world engagement where students confront authentic agricultural challenges, apply interdisciplinary approaches, and develop solutions that address both scientific and societal needs. Through hands-on involvement in soil remediation, sustainable crop production, and farmer-oriented service projects, students internalize the values of dedication, perseverance, and collaboration, which are crucial for their growth as professionals capable of contributing to the modernization of agriculture.

Moreover, the integration of cross-grade mentorship ensures the continuity of knowledge, practical skills, and team culture across cohorts, fostering an environment of peer learning and sustained innovation. The inclusion of international students enriches

the learning ecosystem with diverse perspectives, cultivating a global outlook while reinforcing local agricultural development priorities.

Looking forward, the insights from the "Yuxin" practice team suggest that future innovative talent cultivation in agricultural universities should emphasize the construction of open, integrated, and student-centered practical education systems. Such systems should balance disciplinary depth with interdisciplinary exposure, provide structured opportunities for applied research and social engagement, and cultivate a culture of mentorship and collaboration. By adopting these principles, agricultural universities can better equip graduates to meet the evolving demands of rural revitalization, agricultural modernization, and sustainable development, thereby providing a solid foundation of human capital to support national strategic objectives.

In conclusion, the success of the "Yuxin" practice team highlights the transformative potential of combining research, competition, and practice within a holistic educational framework. Its model offers a replicable reference for other agricultural universities seeking to nurture innovative, socially responsible, and highly skilled professionals capable of driving both scientific advancement and practical agricultural development.

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