

Cultivation Mode of Top-Notch Innovative Talents for Agricultural Engineering Graduate Students Based on Interdisciplinary Research

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Abstract

Interdisciplinary research is an efficient scientific research method in the current scientific and technological field, and plays an irreplaceable role in cultivating top innovative research talents. At present, the integration of non-agricultural engineering majors and agricultural engineering fields is not deep enough, and there is a lack of efficient interdisciplinary talent training system. Therefore, it is urgent to take interdisciplinary as a breakthrough point, to innovate the postgraduate training mode, and to cultivate internationally competitive agricultural engineering top talents. Through breaking the barriers between traditional disciplines, we promote the cross-integration of basic disciplines and applied disciplines. It is needed to carry out effective school-enterprise cooperation and build a diversified practical and innovative education system. By cultivating new disciplinary growth points in the frontier and interdisciplinary fields, we can cultivate a group of leading talents with multi-disciplinary and interdisciplinary knowledge system, facing the modernization of agricultural engineering and high-level talents urgently needed in agricultural development and reform.

Keywords

Agricultural engineering; Interdisciplinary research; Postgraduate training; Top talents.

1. Introduction

The transformation of the world scientific and technological revolution and the China's economic development mode ultimately depend on the level of science and technology and the quality of talents. By 2020, the number of graduate students in China has exceeded 3 million, and more than 10 million high-level talents have been trained for the country. The postgraduate education has strongly supported the implementation of scientific and technological progress and innovation-driven development strategies. Higher requirements have been placed on the development of postgraduate education in the new era. Postgraduate education should pay attention to the cultivation of scientific literacy, innovation ability and moral literacy, so that postgraduates can truly shoulder the important mission of national prosperity, human social progress and development [1].

Most of the traditional postgraduate training system is divided according to disciplines, managed by college, and guided by a single supervisor. However, with the vertical and deep development of discipline professional research, the single-discipline training method is trapped by the solidification of knowledge structure, and the vertical and deep development of disciplines lacks the sustainable motivation, which affects the cultivation of innovative talents. Interdisciplinary is an efficient scientific research method in the current field of science and technology. It is a new way to create knowledge, and plays an irreplaceable role in cultivating top-notch innovative research talents. Interdisciplinary disciplines involve many traditional

disciplines in theory and method, presenting the characteristics of multidisciplinary synthesis, intersection and penetration. Moreover, interdisciplinary are considered to be emerging disciplines that produce science and major breakthroughs. The use of interdisciplinary education to cultivate high-level talents has become an important measure for the strategic development of world-class universities. At the same time, interdisciplinary is also an important way of scientific research and knowledge innovation, and plays an important role in the process of cultivating innovative graduate students.

At present, a large number of studies at home and abroad have reflected the application advantages of microorganisms, enzymes and other bio-related materials in the field of agriculture, as well as the trend of comprehensive use of big data, artificial intelligence and other technologies to achieve smart agriculture. But there is still a lack of synergy in the field of innovative agricultural engineering research that comprehensively uses the advantages of biology, control, computer, environment and other disciplines.

Some problems in the field of agricultural engineering are often complex, which puts forward high requirements for interdisciplinary application. It is difficult to solve efficiently and thoroughly by relying on a single discipline. At present, the cross-integration of non-agricultural engineering majors and agricultural engineering fields is not deep enough, and there is a lack of efficient interdisciplinary talent training system. Therefore, it is urgent to take interdisciplinary as a breakthrough point, innovate the postgraduate training model, promote the deep cross-integration of agricultural engineering and other fields, meet the diversified and differentiated talent needs of modern agricultural development, and cultivate top-notch talents in agricultural engineering with international competitiveness. This is also an important way to promote the construction of 'first-rate universities and disciplines' in colleges and universities and achieve connotative development.

2. Agricultural engineering in the context of multidisciplinary intersection

Agricultural engineering is a comprehensive interdisciplinary, an organic combination of modern science and technology with agricultural industrialization and modernization, and an important guarantee and one of the key scientific and technological fields for implementing the rural revitalization strategy and realizing agricultural modernization. The discipline of agricultural engineering plays an irreplaceable role in promoting the development of agricultural production, promoting the transformation of agricultural development mode and farmers' lifestyle, protecting the ecological environment, making efficient use of production resources and production factors, and realizing the sustainable development of social economy [2].

This discipline takes the complex agro-biological system as the research object, explores the interaction law of environment, equipment and facilities and agro-biology by comprehensively applying the principles and technologies of engineering, biology, information and management science. This discipline studies the engineering technology, equipment and facilities related to the development of modern agricultural industry, and provides the overall solution to the engineering problems related to agro-biological system. The aim is to transform agricultural production mode and improve agricultural production efficiency, and promote the rational use of agricultural resources.

At present, our university has the right to grant the academic master's degree in the first-level discipline of agricultural engineering. There are three second-level disciplines, including agricultural mechanization engineering, agricultural electrification and automation, agricultural biological environment and energy engineering. In recent years, with the development of new technologies such as agricultural environmental protection, biological

information, artificial intelligence, and big data analysis, high-level talents with multi-dimensional knowledge and composite capabilities will be more competitive. The interdisciplinary postgraduate training mode has become an important development trend in the reform of postgraduate training mode (Fig. 1).

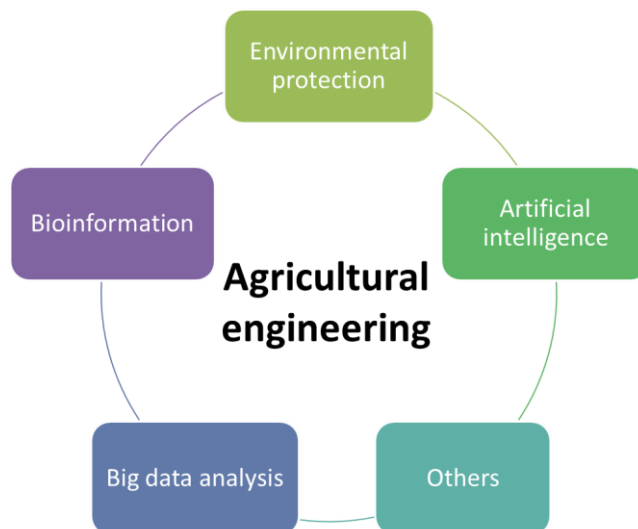


Fig. 1 Overview of agricultural engineering in the context of multidisciplinary intersection

3. The reality and dilemma of cultivating top innovative talents

At present, the following problems exist in the cultivation of top-notch innovative talents for science and engineering graduate students in agricultural universities [2, 3].

3.1. Poor platform and experimental conditions

Software and hardware conditions such as experimental platform, experimental conditions and scientific research projects are crucial to the cultivation of top innovative talents. Agricultural colleges and universities often take agricultural and forestry sciences, life sciences and other advantageous disciplines as their dominant subjects. A large number of school-running resources are concentrated in the advantageous disciplines related to agriculture, resulting in the weakness of engineering disciplines in terms of experimental conditions. Take our university as an example, the original national and Ministry of Education key platforms of the school are all concentrated in agriculture, aquatic products, animal science and other fields.

3.2. Scanty student pool and teachers

The characteristics of postgraduate education in agricultural universities are generally reflected in agriculture-related, and most students of science and engineering majors come from regulating, with unclear development goals and insufficient impetus for scientific research and innovation. In addition, teachers with science and engineering background rarely choose agricultural universities when choosing careers. Tutors with interdisciplinary background of agriculture and science and with interdisciplinary training ability are few. What's more, the science and engineering disciplines of agricultural universities also need to undertake the teaching tasks of the whole school's public basic courses. For example, the department of physics undertakes the whole school's public basic physical theory courses and experimental courses. Therefore, the teaching pressure is high, which further leads to a shortage of resources for postgraduate supervisors.

3.3. Outdated ideas and institutions

At the school level, there is a lack of understanding of cultivating top innovative talents. Top innovative talents should have comprehensive quality development. The cultivation should combine periodicity of agricultural industry and practicality of science and engineering majors. The short-term training process and utilitarian training goal will inevitably lead to a lack of guarantee for the quality of training. At the level of students, influenced by the impetuosity of the society and the training system, students tend to utilitarian learning. There are more students seeking degrees and fewer students seeking learning. Postgraduates lack enthusiasm for learning and innovative awareness and ability in scientific research.

3.4. Single management and training model

The existing management and training model of postgraduate in agricultural universities focuses too much on 'centralized training'. And it has outdated teaching forms and lacks systematic curriculum and scientific research training. Furthermore, it ignores the fundamental requirements of cultivating top-notch innovative talents, such as scientific research motivation, innovative thinking and innovative ability. In addition, there is a lack of interdisciplinary in the training programs, and the administrative management mode is also based on the college system, which is not conducive to the allocation of innovation resources and the implementation of incentive mechanisms.

4. Measures for cultivating agricultural engineering graduate students based on interdisciplinary research

In order to meet the needs of diversified and differentiated talents in the field of modern agricultural engineering, the following measures are mainly adopted (Fig. 2). We will cultivate top agricultural engineering talents with international competitiveness, and accurately improve the quality of agricultural engineering talents training [4-6].

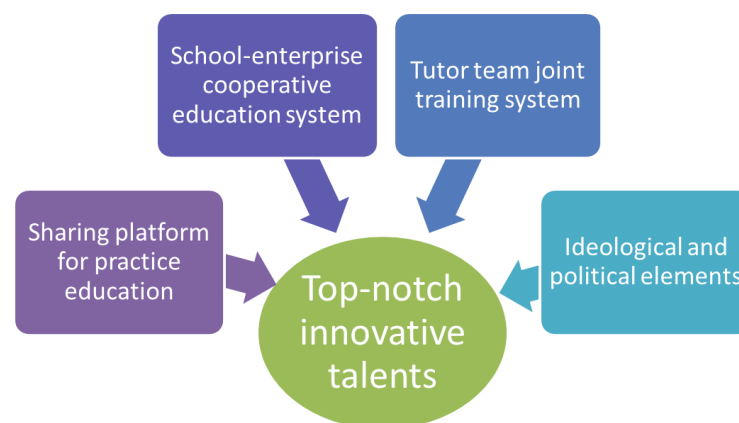


Fig. 2 Major training measures of top-notch innovative talents for agricultural engineering graduate students

4.1. Establish a shared platform for cross-disciplinary practical education by integrating school and social resources

The establishment of a postgraduate training system in the form of a project can break the traditional barriers of colleges and departments, integrate the backbone teachers and teaching forces scattered in related disciplines of different colleges, and establish an interdisciplinary

and cross-school postgraduate training system. Relying on high-level platforms to propose cutting-edge scientific or engineering problems with significant national needs and potential breakthroughs, guiding students to choose topics and providing corresponding funding support. These can help stimulate the innovative vitality of graduate students. Fully utilize the high-level discipline platform, gather top domestic and international expert advisory teams, aim at the major national needs and international academic frontier, guide the topic selection of postgraduates, form a team of domestic and foreign mentors to jointly guide postgraduates, and enhance the innovation and research value of the research directions.

Fully leverage the advantages of disciplines in our school such as agriculture, aquaculture, and engineering, create a cross departmental project platform, coordinate and integrate faculty and laboratory resources of all departments, strengthen the communication between tutors and students with different disciplinary backgrounds, break through the boundaries of the school and department, promote the integration of disciplines, and make the project platform an incubator for cultivating innovative talents in cross-field.

4.2. Construct a diversified practical innovation education system with school-enterprise cooperation

Colleges and universities have a strong team of scientific research, enterprises have advanced equipment and cutting-edge technology, which are the combination of theory and practice of the quality platform. Adopt the system of two tutors inside and outside the school, and jointly develop the training plan of students. Tutors on campus and off campus can provide a full range of cross-disciplinary learning and practice platform for postgraduates by taking advantage of their own advantages, clear division of labor and collaborative guidance. To serve the innovation driven development strategy of Tianjin urban agriculture as the training goal of agricultural science and engineering graduate students, oriented by the project, sharing multi-layer resources of the government, enterprises and schools, is committed to cultivating agricultural science and engineering graduate students into first-class top-notch innovative talents.

Give full play to the advantages of the industry-academia-research in universities, actively develop and maintain the cooperative relationship with enterprises. Start from the needs or problems of the actual production of enterprises, so that postgraduates have the opportunity to participate in the engineering design of actual projects. Then they can constantly apply and integrate the previous learning and get feedback and adjustment in the solution of practical problems, and integrate the knowledge, technology and thinking of different disciplines. From mastering solid foundation to realizing innovation, postgraduates provide feasible solutions to enterprise problems. Through team cooperation and in-depth contact and communication with enterprises, the communication and cooperation ability of graduate students is exercised. Through school-enterprise cooperation, it not only solves the problems of enterprises, but also realizes talent training.

4.3. Establish a joint training system of interdisciplinary tutor teams

On the basis of the original single supervisor, add cooperative mentors according to the needs of graduate research work. The addition of cooperative mentors is beneficial for overcoming the insufficient knowledge of individual mentors, promoting the collision of knowledge structures and systems among mentors from different fields, age groups, and countries. It can greatly improve the quality of interdisciplinary postgraduate training, make students feel the atmosphere of academic teams, and promote the development of interdisciplinary disciplines. When establishing a mentor team, adopt an 'old, middle-aged, and young' echelon combination. Professors or academic leaders can aim at the frontiers of science and grasp the direction of research. Associate professors guide postgraduates in conducting research in depth and

breadth based on the team's research direction, combining theory with practice. Lecturers and senior postgraduates build various practical platforms to quickly enhance their experimental and practical abilities. At the same time, relying on the regular postgraduate meeting system of Internet + Technology, guidance methods at different time nodes such as month, quarter, and year, as well as the mutual feedback mechanism between research tutor groups and postgraduate. It can realize the whole process tracking of tutors in interdisciplinary postgraduate training.

4.4. Strengthen ideological and political education, foster feelings for agriculture, rural areas and farmers, and cultivate the spirit of great artisans

In accordance with the requirements of 'full coverage, institutionalization and pragmatic emphasis', ideological and political elements are organically integrated into the process of postgraduate talent training. On the basis of firmly grasping the new changes in students' main demands and the new characteristics of psychological acceptance in the new era, the historical, political and realistic logic of rural revitalization strategy is expounded based on the classroom, and the historical reasons for the long-term dual structure of China are deeply analyzed. Let the students have a deep understanding of the urgent needs of the rural revitalization strategy and the bottleneck of the weak link, deep understanding of the important mission they shoulder. Take the education of scientific ethics and academic style as an important link in the training of agricultural masters, cultivate good academic style, and strive to become the practitioner of good academic ethics and the defender of good academic atmosphere. The spirit of perseverance, dedication, rigorous work style, excellence, dedication and trustworthiness, innovation and innovation of a great country craftsman runs through the whole training process.

Select three-dimensional and systematic teaching resources, write special teaching materials, formulate training programs and provide corresponding public compulsory courses. With the primary goal of inspiring the noble sentiment of top innovative talents to help rural development, and realize the cultivation of people with feelings. Top innovative talents of 'New Project' and 'New Agriculture' lead college students to become the supporters, advocates, advocates and supporters of rural revitalization strategy.

5. Summary

It is an important way to cultivate top agricultural engineering talents with international competitiveness and realize conformant development by taking cross-discipline as the breakthrough point and innovating postgraduate training mode. It is necessary to break the barriers between traditional disciplines and promote the integration of basic disciplines and applied disciplines. Effective cooperation between schools and enterprises should be carried out to build a multi-practice and innovative education system. It is necessary to cultivate new growth points of disciplines in frontier and interdisciplinary fields, and train a group of leading talents with interdisciplinary knowledge system which are urgently needed in agricultural development and reform, so as to cope with increasingly complex engineering problems and meet the development of the industry.

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