

Agricultural Higher Education in China: Challenges for the Twenty-First Century

Jiaan Cheng

With the twenty-first century imminent, more and more people are thinking about how to produce enough food to meet the requirements of an increasing population. Using energy and environmental resources fully yet sustainably is an important issue. At the same time, people are beginning to realize that agricultural development could solve these problems, because agriculture is a principal way to produce farm products, such as food, on which people rely for existence. In developing countries, most people live in rural areas and their primary job is farm production. Furthermore, agricultural development directly influences the sustainable utilization and development of resources, energy sources, and the environment. Setting up an agricultural system of modern and sustainable development will thus help to guarantee economic and socially sustainable development. In short, agriculture will play a decisive role in the upcoming century.

With the coming of knowledge-based economics, agricultural development will depend on the development of science, technology, and education. To adapt the agricultural education system to fit the requirements of agricultural development, it is necessary to review the history of development in Chinese agricultural higher education in the past century, to understand our future tasks, and to explore approaches for the development of agricultural education in higher learning.

A Survey of the Contemporary History of Agricultural Education

Contemporary agricultural education in China started around the end of the nineteenth century through the early 1920s. The first two schools of agriculture were called Zhejiang Can Xue Guan (school of sericulture, founded in 1897 and later called Zhejiang Secondary School of Sericulture) and Hubei Wu Nong Xue Tong (agricultural school, founded in 1898). Agricultural education was officially included in school systems after the Qing dynasty government promulgated a charter called Zhou Ding Xue Tang (official school systems) in 1903. Henceforth, in each province appeared primary, secondary, and higher learning schools of agriculture. In Zhejiang Province, a teachers' school was set up in 1910 to provide training for teaching staff from the primary and secondary schools of agriculture. The first agricultural institution of higher learning (the forerunner of China Agricultural University) was set up in October of 1905 and began to recruit new students in 1910. During the early years of the Republic of China (1912-1949), Northwest University (1913), Southeast University (1914), Jingling University (1914), and Lingnan University all provided agricultural courses.

Before New China was founded in 1949, agricultural education in China mainly had followed western systems, such as those in the United Kingdom, the United States, Germany, as well as Japan. Statistics from 1949 show that there were a total of 48 agricultural schools of higher learning throughout the country, of which 19 programs covered farming and forestry, and these schools had 10,726 full-time undergraduate students, 20 graduate students, and 937 teachers.

The Agricultural College of Zhejiang University originated from the teachers' school (1910) and was officially named the Agricultural College of National Zhejiang University in January 1929. In July 1952, to further agricultural development and speed up the training of agricultural specialists, the central government began restructuring higher learning institutions all over the country by separating agricultural education from the comprehensive universities. The government set up new schools providing only agricultural education in regional areas; by the beginning of 1953, there were 16 of these programs.

But with the development of agriculture, agricultural production became more and more dependent on the liberal arts, engineering, economics, and similar disciplines. Therefore, since the 1960's, agricultural schools developed themselves toward being multidisciplinary universities. The number of programs they offered reached 71 and included agronomy, horticulture, plant protection, husbandry, animal medicine, agricultural engineering, food processing, agricultural economics, environmental resources, and the biological sciences.

Zhejiang Agricultural College was reestablished based on the Agricultural College of Zhejiang University in October 1952, and was enlarged and renamed Zhejiang Agricultural University in 1960. In September 1998, it was merged back into Zhejiang University with Hangzhou University and Zhejiang Medical University.

After a century's work, agricultural education in higher learning has developed well. According to statistics from the State Ministry of Agriculture, in 1997-1998, there were 62 agricultural colleges and universities in China, including 4 teachers' colleges of agricultural technology, with 179,875 full-time undergraduate students, 7,169 graduate students, and 24,794 teachers. Since New China was founded, these colleges and universities have trained over 700,000 students as agricultural specialists who have made great contributions to the development of agriculture, to rural economics, and to the modernization of agriculture.

Challenges for Agriculture in China

China is an agricultural country with little arable land and a very large population. Therefore, the farming of rural areas plays a decisive role in social and economic development. As the next century approaches, agriculture in China is facing the following severe challenges.

1. **Large population and few natural resources.** For each person in China, there is only one-third of the required land supply and one-fourth of the water resources compared with the worldwide average. Therefore, the primary job in China is to produce enough farm products to meet the requirements of an increasing population with only meager natural resources.
2. **Multiple targets.** As people's lives improve, their consumption level also increases. Their requirements for farm products change from quantity to quality and a demand for diversified products. On the other hand, farmers' enthusiasm for farm production is dependent on their income, and small-scale farmers are the major agricultural producers in China. Therefore, raising proportional profits for farm production and increasing farmers' income while satisfying consumers' demands is becoming a major focus in our consideration of rural areas.
3. **Rural development as a whole.** Over 70 percent of the population in China live in rural areas. With labor productivity increasing, more workers will move away from farming and change to other work. This movement will inevitably bring social problems to cities, however, as a large labor force relocates from rural to urban areas. Therefore, it is necessary to develop agricultural production suited to a new industrial structure, and to develop secondary and tertiary industries related to agriculture, which will attract workers to county and township areas.

4. **Sustainable development.** Building intensive and sustainable agriculture is the target of modern Chinese agricultural policy. While achieving high production, high quality, and high profits, there must also be a concern for resources and environmental protection. Natural resources should be used rationally and ecologically for sustainable economic and social development.

The discussion of these four challenges shows that the development of Chinese agriculture is strongly dependent upon the way in which farmers interact with their rural surroundings and how social and economic developments are integrated with natural resources and environmental protection. Therefore, the government has proposed a policy called revitalization of agriculture through development of science and education.

The Reforms of Agricultural Education in Higher Learning

Agricultural schools of higher learning are currently reforming their targets, structures, and functions to fully adapt agricultural education in higher learning to the requirements of the latest scientific and technological developments. The adjustments will provide better service for the development of agriculture and of rural areas. This section describes four targets of the educational reform policy.

To further full-scale quality-oriented education

The main point of agricultural education reform in higher learning schools is to change the pattern of personnel training in order to further full-scale quality-oriented education. The traditional pattern of personnel training was to train students to be professionals with a good knowledge in a specialty. Curricula were arranged according to specialty and students were taught mainly through lectures. However, the development of science and technology coupled with economic development demands that more emphasis be placed on the training of innovation and creativity. Far into the next century, China will be a society where agricultural, industrial, and knowledge-based economics co-exist. And the resource of qualified personnel will become a main element in promoting the social economics of a three-part economic structure. Therefore, to succeed in this target, it is necessary to adjust and reform education at every step.

Reforming the curriculum system

The setting-up of the curriculum system is a key step by which the target of training qualified personnel can be accomplished. New curricula are developing based on intensified basic theory, broad knowledge, emphasis on practical ability and multi-disciplines, and improvement of all-round abilities. These new curricula include eight components: ideological accomplishment, knowledge of humanity, physical conditions, practical ability, scientific theory, professional knowledge, knowledge of related disciplines, and technical skill training. The first four components emphasize the basic humanities and the second four emphasize the basic sciences. The reasonable arrangement of the components will guarantee the training of students with broad, quality-oriented abilities.

Improving education and teaching methods

Teaching methods are the ways of carrying out curricula, which directly influence the effects of knowledge transformation. Using heuristics and discussion in teaching, will reduce the time used in the classroom and add to time out of the classroom. These methods will stimulate students to think independently and increase their creativity, let them experience and understand the process of how knowledge develops, and train them to have both a scientific and an innovative mind. For this reform, the central government will increase its investment to improve laboratory and library facilities and to develop computer network systems. Then, students will develop their own abilities of collecting and dealing with information, of obtaining new knowledge, and of analyzing and solving problems through full use of various resources and a computer-aided teaching system.

Strengthening practical teaching links

Practical teaching is an important link not only in examining the exact results of curriculum systems and teaching methods being used, but also in training the abilities of innovation, experience, and creativity. Practical teaching links include teaching practice, scientific research, technical development, extension activities, and social services. The contents of experimental curriculum systems will be reformed and new teaching practice systems will be established to train operational ability according to specialty or discipline. The “advisor’s system” will be adopted to provide environments in which students will take part in scientific research activities and train their innovative abilities. Experimental bases will be set up to offer opportunities for students to join in social activities and to induce a spirit of cooperation and unity.

To adjust specialty and discipline structures

Specialty structure depends on a school’s understanding of the requirements of scientific and technological development as well as on the practical situation of their discipline construction and teachers. Therefore, scientific, technological, and economic development, the setting-up of specialty structure, and the ability to run a school are all dependent on each other. Agricultural schools of higher learning must continually adjust their specialty structures, strengthen their disciplines, and improve their ability to run schools according to the latest scientific, technological, and economic developments.

Continuing specialty adjustments

During recent years, the number of specialties in agricultural schools of higher learning has been reduced to 16. Areas of professional specialties now include agronomy, horticulture, plant protection, sericulture, tea science, animal science, animal medical science, agricultural economics and management, and agricultural resources and environments. Some of these, however, are still too specific to a narrow technical area and should be further adjusted.

Developing comprehensive universities

Agricultural schools of higher learning in China have already been developing from colleges toward being multidisciplinary universities since the 1960s. In recent years, important points of the reform have been to enlarge the scale of school administration, to intensify different disciplines overlapping each other, to raise resource utilization, and to build the schools into comprehensive universities. An excellent example of this reform is the new Zhejiang University, now the largest University with the most diversified scientific and technical disciplines in China, created by combining Zhejiang University, Hangzhou University, Zhejiang Agricultural University, and Zhejiang Medical University. Combining Zhejiang Agricultural University into Zhejiang University has merged agricultural education into the comprehensive university, allowing attention to all disciplines, especially biotechnology, information technology, and materials science, and improved the basic level of agricultural specialties.

Intensifying the study of the environment and sustainable development

The environment and sustainable development is a critical problem for the next century. In a big country such as China, with a large population and limited natural resources, guaranteeing the sustainable development of the environment and resources is an important issue. The sustainable development of agriculture is the basis of social and economic sustainable development. Therefore, it is necessary to intensify the study of environmental education and sustainable development, and to set up specialties related to those topics.

To combine education with science, technology, and economics

Agricultural institutions of higher learning are the main forces in developing agricultural science and technology as well as agricultural economics. The three basic problems institutions must address are qualified personnel training, scientific research, and social services. To advance education in economics, science and technology, schools must make necessary adjustments to their organizational and management systems.

Setting up systems adapted to scientific and technological innovations

Adjusting the organizational structure of agricultural schools of higher learning will require setting up a system with departments, research units, development units, and entrepreneurs working together. Departments will be responsible for undergraduate education; research units will conduct graduate education and scientific research; and development units will oversee the development and extension of scientific and technological achievements. Finally, entrepreneurs will cooperate with, or buy out, the achievements from the development units and turn them into products on a large scale, if it is profitable. Usually, entrepreneurs will be situated off-campus but within the high-tech development zones, which will ensure the execution of the three functions: education, scientific research, and social service. Entrepreneurs will thus form a close link with higher learning schools and their local economies.

Strengthening the combination of industrial circles, schools, and research institutes

Another task will be to further the combination of schools of higher learning with industrial circles and research institutes. This includes encouraging entrepreneurs to set up research units in higher learning schools and having these schools establish practice bases with entrepreneurs. Through various means, higher learning schools will join with entrepreneurs to speed up and extend scientific and technological achievements to entrepreneurs, improve technological innovation, and develop new economic growth points. At the current time, the “Dandelion Project” has been proposed by Zhejiang University and supported financially by the government and enterprises. Postdoctoral stations are already set in some cities or enterprises. Based on research demands and technical needs of enterprises or governments, the University will select graduates with suitable backgrounds and send them to work at these stations where, with help from advisors, they will solve problems or turn their own research achievements into products. The graduates may stay in these positions and become key managers or researchers after they finish the projects in the postdoctoral period.

Adjusting the layout of agricultural schools

Agricultural schools of higher learning are divided into three types according to the way they function within the whole country. The first type is the key national schools of higher learning that are the centers of agricultural education and scientific research for the entire country. They are the basis for basic and applied research in agriculture and are the training centers for postgraduates. The second type is the key regional schools of higher learning that are the regional centers of agricultural education. These schools provide agricultural science and technology and rural economic services for their respective areas. The last type is the provincial teaching schools of higher learning which are the centers of provincial agricultural education and scientific research. These schools primarily provide training to skilled personnel from their own provinces. Reasonable layout of these levels will help form a system of agricultural education of higher learning adapted to agricultural and rural developments.

To globalize agricultural education in higher learning

Since the reform and opening policy began, agricultural schools of higher learning in China have strengthened their ties with schools in other countries, not only by inviting foreign experts to China for visits and to lecture, but also through sending Chinese abroad for visits and study. This exchange has included establishing official ties with other institutions. Zhejiang University has established formal relationships with over 100 universities and institutes in foreign countries. With the globalization taking place in science and technology and in economics, education will surely experience globalization as well. Agricultural education in higher learning in China is also quickening its step to realize educational globalization.

Intensifying Ability Training in International Exchange

The globalization of science, technology and economics demands a new requirement for the training of skilled personnel: Ability Training in International Exchange. To meet this requirement, schools will add optional courses to their curricula, that will let students learn more about the culture, science and technology, economics, and politics of the whole world. At the same time, offering English lectures and courses and improving the Internet system will better train students in foreign languages and computers. In addition, Chinese students can participate in exchanges with students in foreign countries, as well as attend lectures, through the Internet.

Setting up an alternative training program of skilled personnel

To further intensify educational globalization, the “Sandwich Program”, an alternative training program for skilled personnel, should be carried out. For undergraduates, after two years of study and based on financial support, the best students will be chosen to study abroad for one to two years; then, they will receive their academic degrees in their home country. Graduate students who have completed their studies can go abroad for research on their thesis, and then defend their thesis in their home country. To extend this training program, we need to exchange students with schools in other countries and arrange for reciprocal coverage of expenses.

Enhancing international cooperative research

For many years, Zhejiang University has attached great importance to internationally cooperative research. The University has a very good relationship with international institutions, schools, and scientific and research units such as the Food and Agriculture Organization of the United Nations, the International Atomic Energy Agency, the Rockefeller Foundation and the International Rice Research Institute, among others.

To further intensify international cooperative research, Zhejiang University attracts foreign experts to China to carry out cooperative research work by setting up national key laboratories and engineering centers. Similarly, it will encourage its professors to go abroad and establish cooperative relationships with schools where they can carry out their cooperative research work as well.

Conclusion

In the new century, agricultural schools of higher learning must serve the developments of agricultural science and technology and rural economics, and must further their own evolution based on the developments of agricultural science, technology, and rural economic construction.