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Exploration and Practice of Personnel Cultivation for Agricultural Mechanization and Automation Specialities

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Abstract Firstly, based on significance of developing agricultural mechanization and automation and current situations of agricultural mechanization and automation specialities in colleges and universities, we put forward objectives of personnel cultivation for agricultural mechanization and automation specialities. Then, we analyze the exploration and practice of personnel cultivation for agricultural mechanization and automation specialities from four aspects, including course system setting, teaching materials construction, laboratory construction, and construction of practical teaching link. Finally, it is expected to provide references for running schools and cultivating excellent professional personnel.

Key words Agricultural mechanization and automation, Personnel cultivation, Characteristic specialities

Actively developing agricultural mechanization is an important guarantee of developing modern agriculture and building new socialist countryside, while developing agricultural mechanization is closely related with excellent personnel. To satisfy demands of agricultural machinery personnel of China in the 21st century, some educators have conducted researches in course construction^[1], direction of speciality construction^[2], and how to promote rapid development of agricultural mechanization and automation specialities^[3]. The former agricultural mechanization and automation undergraduate specialities of Jilin University are agricultural mechanical design and manufacture undergraduate specialities of Jilin University of Technology. To bring into play advantages of agricultural mechanization discipline in Jilin University, we should establish disciplinary, reasonable and characteristic personnel cultivating program and teaching system for agricultural mechanization and automation according to current situations of agricultural modernization and demands of market economy. In view of this, we analyze the exploration and practice of personnel cultivation for agricultural mechanization and automation specialities from four aspects, including course system setting, teaching materials construction, laboratory construction, and construction of practical teaching link, in the hope of providing references for running schools and cultivating excellent professional talents.

1 Objectives of personnel cultivation for agricultural mechanization and automation specialities

Operating fields of China's agricultural mechanization are developing towards whole process of agricultural production, and agricultural products processing is developing towards deep

processing. To suit this development and wide field and high quality teaching reform requirements, we should help graduates possess following knowledge and abilities. Firstly, graduates should grasp basic theories of mechanics, information science, automation technology, agronomy, and management science. Secondly, graduates should master basic knowledge and skills of agricultural equipment design, test, type selection and support, operation, and maintenance. Thirdly, graduates should possess new process, new technology and new product development, popularization and application abilities of agricultural mechanization and automation. Fourthly, graduates should have basic abilities of planning of agricultural mechanization system and enterprise management. Fifthly, graduates should be familiar with China's agricultural mechanization standards, policies, laws and regulations, and know front line and development trend of agricultural mechanization and automation both at home and abroad. Sixthly, graduates should have a good command of a foreign language, be able to proficiently inquire about documents and materials, and have proper ability of scientific research and technical exchange. Seventhly, graduates should possess some knowledge of market economy, laws, and technical regulations, and humanities. Finally, they should have survey, decision making, organization and management abilities, and environmental protection awareness.

Under the guidance of the above cultivation objectives and requirements, Jilin University mainly focuses on following knowledge and abilities: first, knowledge and ability in performance design of agricultural machinery and automation equipment; second, knowledge and ability in agricultural mechanization planning, operation and management of agricultural machinery.

2 Practice of personnel cultivation for agricultural mechanization and automation specialities

2.1 Course system setting Course system is central part

of building personnel cultivation program. The difference of course system setting is one of the most significant and direct factors that distinguishes the same speciality of different colleges and universities^[4]. Taking courses of mechanical engineering discipline as the main line, course system of agricultural mechanization and automation specialities in Jilin University consists of general education course module, basic professional course module, professional course module, and practice links (listed in Table 1). Totally, there are 215 credits, including 184 credits of compulsory courses and 31 credits of selec-

tive courses. In professional courses, Jilin University deletes general field operation machinery and fixed agricultural machinery theories, and adds new mechanical design theories and agricultural facilities and equipment both at home and abroad. For instance, agricultural engineering, protective cultivation, and sustainable development. It is hoped to make students know the front line and development trend of agricultural mechanization and automation. In addition, to improve students' foreign language level, Jilin University has set bilingual teaching and professional foreign language courses.

Table 1 Credit allocation for cultivation program of agricultural mechanization and automation specialities

| Nature of course | Credit | Percentage//% | Ability cultivation |
|---------------------|--------|---------------|--|
| General education | 82 | 38.1 | Grasp basic theories of mechanics, information science, automation technology, agronomy, and management science; have a good command of a foreign language, be able to proficiently inquire about documents and materials, and have proper ability of scientific research and technical exchange; possess some knowledge of market economy, laws, and technical regulations, and humanities, and have survey, decision making, organization and management abilities, and environmental protection awareness |
| Basic professional | 66 | 30.7 | Master basic knowledge and skills of agricultural equipment design, test, type selection and support, operation, and maintenance; possess new process, new technology and new product development, popularization and application abilities of agricultural mechanization and automation; have basic abilities of planning of agricultural mechanization system and enterprise management; be familiar with China's agricultural mechanization standards, policies, laws and regulations, and know front line and development trend of agricultural mechanization and automation both at home and abroad |
| Professional course | 15 | 7.0 | |
| Practice | 52 | 24.2 | Cultivate students' experimental skills, engineering practical ability, scientific research ability, and innovation ability |

2.2 Teaching materials construction Since the founding of agricultural mechanization and automation specialities, Jilin University has compiled a lot of teaching materials. To strengthen the upgrading of teaching contents and construction of teaching materials, it presently compiled *Design and Application of Agricultural Engineering Testing System*, *Regression Design and Optimization*, *Experimental Design and Optimization*, and *Executive Element and Control*. The construction of these teaching materials plays an important role in cultivating students' basic theories of information and agronomy, and basic knowledge and skills of agricultural equipment design, test, type selection and support, operation and maintenance. Besides, teaching materials construction can bring along course construction, promote reform of teaching contents and methods, and can improve teaching quality and construction of teaching teams.

2.3 Laboratory construction In recent years, along with increase of fund input, laboratory environment and equipment for agricultural mechanization and automation have been greatly improved. The laboratory area reaches 4 600 m², while laboratory equipment and instrument increase to over 580 sets. The laboratory management adopts vice president responsible system and laboratory director assisting management model, to realize standardized of system and scientific management. Newly introduced personnel of laboratory should have academic qualification above master degree, in the hope of enriching full-time experiment teaching and management teams, and improving experiment teaching level. Furthermore, it is required to optimize laboratory building, instrument, and equipment resources

in accordance with course and experiment levels. Also, we should increase design-oriented and comprehensive experiment items according to objectives of personnel cultivation for agricultural mechanization and automation specialities, to constantly improve students' practice and innovation ability. We can learn from laboratory construction, operation and management experience of other same kind colleges and universities, with the aim of constantly improving experiment teaching contents, methods and quality, and enhancing students' overall qualities. In addition, on the basis of accomplishing undergraduate experiment teaching tasks, laboratory is also open to students through reservation and basic skill training, to strengthen students' practical manipulative ability, and energetically support and encourage students' innovation.

2.4 Construction of practical teaching link

2.4.1 Experiment teaching. Experiment teaching is an essential link in carrying out professional education and teaching. Experiment teaching mainly includes basic experiments (such as physical experiment, chemical experiment, and computer application experiment), professional basic experiments (such as mechanics of materials, fluid mechanics, theory of mechanics, and mechanical design, etc.), and professional characteristic experiments (agronomy basis, agricultural materials, and agricultural machinery, etc). Basic experiments and some professional basic experiments will be completed by relevant disciplines of Jilin University. To meet requirements of professional cultivation objectives, professional experiment teaching sets four engineering training levels, namely, basic level, design level, comprehensive level, and research level. In accordance

with experiment courses , Jilin University has prepared appropriate experiment teaching syllabus , experiment item sheet and experiment operation instructions. Currently, there are 12 courses and 35 experiment items in this speciality. Among these, the comprehensive and design experiments take up over 80%. Experiments are carried out as per requirements of teaching syllabus and arrangement of teaching schedule. Experiment supervising teachers offer meticulous guidance for students,

Table 2 Arrangement and purpose of practice teaching

| Practice items | Duration of practice | Ability cultivation |
|-------------------------|----------------------|---|
| Metal working | Two weeks | Raise students' consciousness of combining theory and practice together , train students' basic operation skills of machining, benching, and welding, and cultivate students' abilities of survey and research, problem observing, analyzing and solving, and enhance their ability of site organization and management. |
| Professional production | Four weeks | Provide students with preliminary perceptual knowledge of types and materials of agricultural products, agricultural machinery, agricultural enterprises, and agricultural mechanization industries; stimulate students' interests in learning these professional courses; make them know current situations and development trend of biological engineering field. |
| Driving | Two weeks | Make students be able to independently drive agricultural machinery , and know driving features of agricultural machines and tools, to fully consider driving features at the time of design of agricultural machines and tools, and to improve the design practicability. |
| Graduation | One week | Let students have a deep understanding of current development situations of domestic and international agricultural mechanization, significance of graduation design, existing problems of domestic and international researches , to enhance their understanding of professional knowledge and preparation for graduation design (thesis) |

2.4.3 Practice of design link. The design link of agricultural mechanization and automation specialities of Jilin University includes course design and graduation design. Course design is a unique teaching method in engineering discipline. Jilin University has set design for engineering graphics comprehensive practice, mechanics of materials, theory of mechanics, mechanical design and manufacture technology basis, to cultivate students' ability of applying basic theoretical knowledge into practice. Moreover, the program for graduation design (thesis) may include design, scientific research and computer software design. To assist students in preliminarily grasping design methods and skills of agricultural machinery, and to realize the cultivation objectives, three weeks before the graduation design are provided for professional course *Design of Agricultural Machinery Parts*.

Graduation design is " a big drill " of students' knowledge^[5]. In Jilin University, the graduation design (thesis) of agricultural mechanization and automation specialities is carried out in the fourth academic year. Supervising teachers firstly provide comprehensive and innovative graduation design programs that are more than the quantity of students as per personnel cultivation requirements, and submit *Graduation Design Assignment*. Both students and teachers have two-way choice , and supervising teachers will provide guidance in whole process of graduation design. Students conduct surveys and consult literature according to selected project. Then, they complete summary of literature, translation of foreign language, and opening report. They can bring into play their knowledge, devote themselves to the design, complete design task, summarize materials, and accomplish oral defense of thesis. Through the graduation design (thesis), it is expected to improve students' ability of analyzing and solving problems, as well as ability of engineering practice.

assess the whole experiment course , and incorporate results of assessment into score rating of courses.

2.4.2 Practice teaching. To improve effect of practice teaching, the university sets metal working, professional production, driving, and graduation practices (listed in Table 2). It is expected to deepen students' understanding of professional basic course and professional course , and to improve students' overall qualities.

3 Conclusions

With many years of exploration and practice, Jilin University has obtained noticeable effect in personnel cultivation for undergraduate specialities of agricultural mechanization and automation. Graduates from these specialities have solid basic knowledge, professional knowledge, and strong design and management abilities. Along with in-depth exploration and practice, the content system of agricultural mechanization and automation specialities in Jilin University will be improved constantly. It is required to turn to new agricultural revolution in science and technology; develop front-line disciplines; fight off international competition; constantly improve the level scientific and technical innovation in China's agricultural mechanization field; implement innovation-oriented national development strategy, to realize objective of agricultural modernization. In conclusion, as long as we constantly improve personnel cultivation program and teaching system for agricultural mechanization and automation specialities in accordance with demands of China's agricultural modernization and mechanization development, we can undertake this historical responsibility of providing innovative talents for development of agricultural mechanization, and play a significant role in the course of development of agricultural mechanization.

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