

Exploration and Practice of School Enterprise Integration Teaching Mode in Crop Breeding

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Abstract: Crop breeding is a compulsory course of seed science and engineering, and it is a course with strong applicability and practicality. In teaching, the author found that there were some problems in the course, such as students' slack in active learning and lack of enthusiasm. In order to improve the quality of teaching, the teachers of college of agronomy in Jilin Agricultural Science and Technology University had integrated crop breeding into the teaching mode of the actual needs of the enterprise posts, and had made a deep exploration and reform in integrating crop breeding into the practical teaching mode, teaching content, teaching methods and evaluation methods of enterprises. The teaching practice show that the teaching mode of integrating the needs of enterprises' posts was conducive to enhancing students' understanding of the importance of crop breeding, mobilizing students' initiative in classroom learning, improving students' practical ability, and improving the teaching quality of crop breeding in an all-round way.

1. Introduction

As one of the core courses of plant production major in agricultural colleges and universities, Crop Breeding is the concentration and achievement of human beings in long-term agricultural production activities and scientific experiments [1, 2], which is compiled on the basis of fully absorbing domestic and foreign research theories and technologies in combination with the actual situation of seed industry in China. In the course system of seed science and engineering major of Jilin Agricultural Science and Technology University, Crop Breeding is the backbone course, which mainly includes crop breeding objectives, germplasm resources, breeding methods (including introduction and selection breeding, cross breeding, heterosis utilization, mutation breeding, distant hybridization, ploidy breeding, population recurrent selection, and the application of biotechnology in breeding), breeding methods of main target traits (including disease and insect resistance, stress resistance and crop quality traits), and the main work involved in the whole process of crop new variety breeding, such as seed production. For enterprises, the new variety selection technology based on the theory of crop breeding is an effective way to control the quality of commercial seeds, and the certification of new crop varieties is the evidence of commercial seed circulation, so the effect of seed selection and breeding affects the survival and development of enterprises. In the process of breeding new varieties of crops, the most important and basic quality is to select new varieties according to the approved standards, such as national standards, provincial standards and enterprise green channel standards.

In order to train innovative talents with solid practical skills for agricultural enterprises and employers, in this paper, the teaching mode of "school-enterprise integration" is used to improve the shortcomings of existing teaching and stimulate students' innovative thinking and initiative learning enthusiasm. First of all, a real case of an enterprise - the case of variety rights protection is integrated into the introduction part of the theory course to guide students to improve their understanding of the importance of variety rights. Secondly, according to the employment standards and practical needs of seed enterprises, the teaching content of crop breeding, especially the experimental teaching content, is reasonably arranged to achieve seamless connection between talent training and enterprise needs. Finally, in the course assessment, not only students' basic skills

(mastering the basic theory and knowledge of main crop breeding), but also their ability of new variety selection (students' initiative and creativity) should be examined, so as to ultimately cultivate theoretical and practical new variety selection experts and talents for seed enterprises.

2. The Reform Goal of School-Enterprise Integration Teaching Mode

Crop Breeding is one of the key courses of seed science and engineering major in JiLin Agricultural Science and Technology University. In the reform of school-enterprise integration teaching mode, the goal is always to train the theoretical and practical talents who are needed by modern seed industry [3, 4]. To this end, the course system is optimized, and the theoretical teaching hours and experimental teaching hours are allocated reasonably basically according to 1:1^[5]. In addition, more attention is paid to the cultivation of students' practical ability on the basis of theoretical knowledge training. In theory teaching, flexible teaching contents are adopted, such as pre class preview, classroom questioning and discussion, case analysis, to cultivate and mobilize students' interest, so as to improve the quality of theory teaching. In the experimental teaching, on the basis of the experimental teaching contents such as grain crop breeding module, cash crop breeding module, oil crop breeding module, SSR molecular marker testing seed authenticity (DNA authenticity) experiment, DUS testing experiment, transgenic testing experiment and disease resistance identification experiment have been added to truly meet the needs of seed enterprises and society. When evaluating students' learning effect, in order to avoid scoring in a "one-size-fits-all" way, students' literature review scores, classroom quizzes, homework after class, flipped classroom scores, students collaboration and innovation abilities are all included in the assessment process.

3. Course Outline of School-Enterprise Integration Teaching Mode

From traditional breeding (optimization method), conventional breeding (hybridization and heterosis utilization) to modern biotechnology breeding (genetic engineering and molecular breeding), crop breeding has made great progress in its breeding methods and technical means^[6]. Furthermore, research and development of new crop varieties is an important cornerstone of the development of modern agriculture. For seed enterprises, the R&D ability of breeding researchers will directly affect the survival and development of enterprises. Therefore, how to train qualified breeders for seed enterprises and agricultural research institutes should be taken into account when formulating the course outline of Crop Breeding after reform. In the course of teaching, the role of various teaching indexes and reform goals in the research and development of new varieties of seed enterprises should be made clear. The study content and process of crop breeding should be systematized, and the relationship and level of each part of teaching content should be clarified. A highlight of this teaching reform is to let students understand the significance of each crop breeding goal through the real cases of seed enterprises, so that teachers can teach and students can listen with problems.

The subject structure of Crop Breeding outline remains unchanged, as shown in Figure 1, but the teaching level has changed. The theoretical teaching and experimental teaching contents are arranged in an overall way, and they correspond one to one. Theory should be connected with practice, applied to practice and condensed from practice. The introduction part starts with the typical cases of variety infringement in seed enterprises, to guide students to understand the importance of new variety breeding, and let students understand that owning variety right is the only way for seed enterprises to legalize the sale of improved varieties.

The chapter of breeding methods for main target traits is carried out theoretically and experimentally. In the course of theory teaching, students are taught how to select the target traits, and in the course of experiment teaching, students are made clear which diseases are "one-vote-down", so that they can master the evaluation and grading standards of disease resistance of main crops, and organically combine the courses of agricultural pathology and crop breeding in a targeted way, which will help students to understand the internal relationship between disciplines while broadening their knowledge.

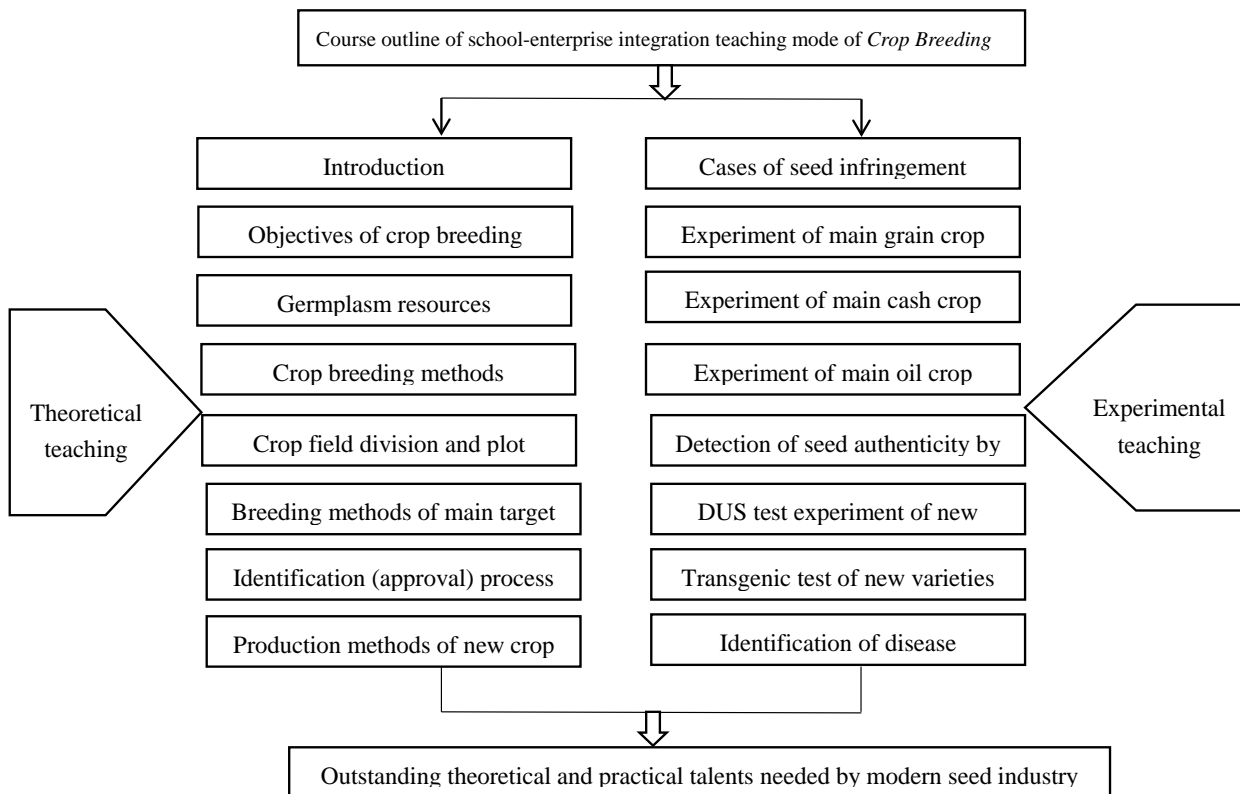


Figure 1 Teaching outline of *Crop Breeding* after reform

4. Evaluation and Verification of Students' Performance in the Mode of School Enterprise Integration Teaching

In order to improve the effect of the teaching reform of the course of Crop Breeding, in this study, Jilin Xintiandi Agricultural Development Co., Ltd., a director unit of school enterprise cooperation of JiLin Agricultural Science and Technology University, is taken as an example to combine the theoretical teaching and experimental teaching of crop breeding and optimize the assessment mechanism of students' performance. Generally, the previous assessment method of courses in the school is mainly composed of the traditional "test paper score + experiment report", and most of the paper scores account for 60% of the total, which leads to the situation that students often rush to study at the last moment. In order to promote students' active learning and strengthen the cultivation of innovation ability and hands-on ability, the performance accounting of Crop Breeding is divided into three parts according to the actual employment standard of Jilin Xintiandi Agricultural Development Co., Ltd., as shown in Figure 2. When the performance is evaluated, the weight of each assessment part is defined.

Among them, the assessment weight of theoretical knowledge accounts for 40%, the comprehensive ability of practice accounts for 50%, and the innovative ability accounts for 10%. The theoretical knowledge score is mainly composed of the quizzes in class, the homework after class and the final exam scores. The experimental operation is completely carried out in Jilin Xintiandi Agricultural Development Co., Ltd. according to the comprehensive performance of students' doing experiments and participating in enterprise practice, including the evaluation of the standardization of experimental operation, students' hands-on ability, teamwork, scientific thinking, accuracy of results and other comprehensive practical abilities. The innovative ability is mainly evaluated by the students' paper scores, the ranking of innovative projects (national and provincial level) and the publishing of scientific research papers, and the flipped classroom scores in the course teaching. In the second semester of 2018-2019 academic year, the assessment method of Crop Breeding was tried in the Seed Science and Engineering Major. The students reported good results, with comprehensive scores of more than 85 points. The teaching effect of teachers was evaluated as excellent.

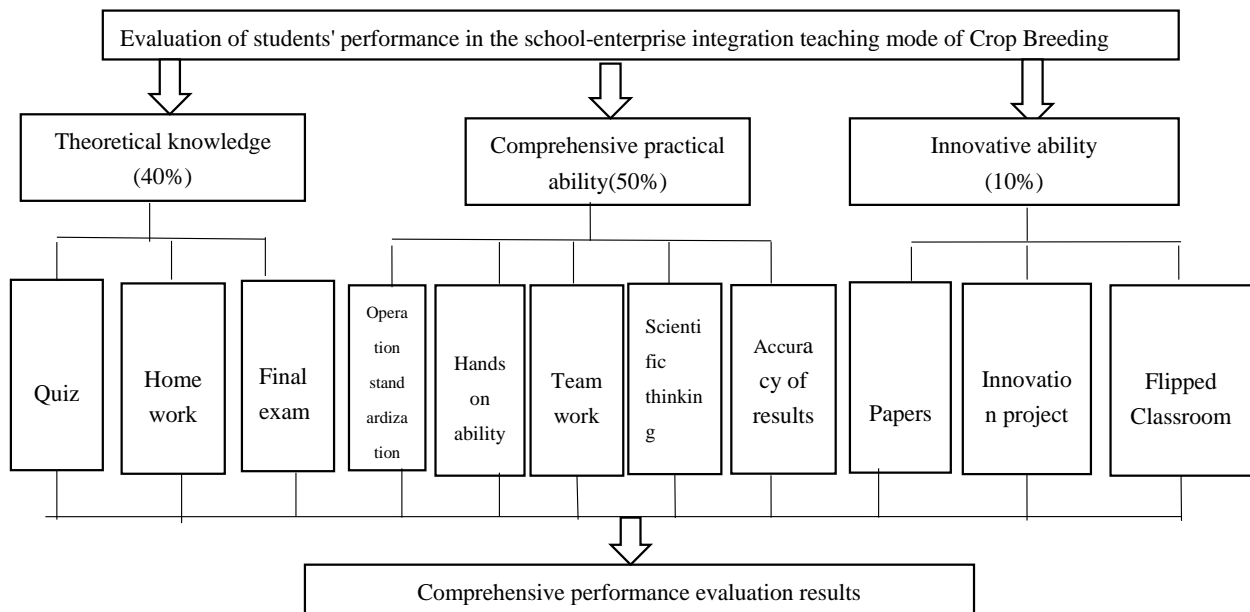


Figure 2 Student's academic performance verification method of *Crop Breeding*

5. Conclusion

The rapid development of modern seed industry has put forward new and higher requirements for crop breeding practitioners. Only by cultivating excellent theoretical and practical talents, can we further promote the healthy development of seed industry and realize the agricultural modernization. Therefore, the teaching reform of *Crop Breeding* is imperative. In order to improve the teaching quality of *Crop Breeding*, the author will continue to explore, practice and improve the school-enterprise integration teaching mode in the context of "new agricultural science", fully mobilize and play the subjective initiative of students, enhance the learning initiative of students, improve the teaching quality of *Crop Breeding*, and play a good role in guiding and promoting the cultivation of seed industry talents.

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