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Abstract	The report presents the results of the development of educational programs Agroecology in three partner universities, the results of analytical work to determine the relevance, content, goals and objectives of the EP. The qualification requirements and the graduate model of the Bachelor of Agroecology have also been developed, taking into account the opinions of employers and potential consumers.
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DEFINITIONS, ABBREVIATIONS

The following basic concepts and definitions are used in this report:

Academic degree is a degree awarded by educational organizations to students who have mastered the relevant educational curricula, based on the results of the final certification.

Academic hour is the time of contact work of a student with a teacher according to a schedule for all types of training sessions (classroom work) or according to a separately approved schedule within a set time frame in order to achieve certain educational goals.

Academic period (Term) is the period of theoretical study, established independently by the educational organization in one of three forms: semester, trimester, quarter.

Assessment is a general concept that applies to all methods and actions for evaluating the results (knowledge, skills and competencies) of a person, which leads to an understanding of the level of knowledge, skills and competencies.

Competencies are the qualities of the subject of activity that ensure the fulfillment of the tasks of professional activity of a certain qualification level.

Course Description is a short description of the discipline (consists of 5-8 sentences), including the goals, objectives and content of the discipline.

Descriptors are ones that reflect the full range of learning outcomes or competencies.

Descriptors used in the field of higher education are level descriptors that differentiate into knowledge and understanding, application of knowledge and understanding, reasoning (the ability to understand correctly), the ability to learn, communication skills).

Educational achievements of students - knowledge, skills and competencies of students acquired by them in the learning process and reflecting the achieved level of personal development.

Elective disciplines are academic disciplines included in the elective component within the framework of established credits and introduced by educational organizations, reflecting the individual training of the student, taking into account the specifics of socio-economic development and the needs of a particular region, established scientific schools of higher education institutions.



European Credit Transfer System (ECTS) is loans that are assigned to qualifications and curricula in general, as well as their educational components.

Experience is a conscious activity, knowledge and skills that can be acquired and effectively used over a certain period of time

Independent work of a student (IWS) is work on a specific list of topics allocated for independent study, provided with educational and methodological literature and recommendations, controlled in the form of tests, control papers, colloquiums, abstracts, essays and reports.

Industry Qualifications Framework is a structured description of the qualification levels recognized in the industry. Each level is described by a set of uniform parameters (criteria) descriptors.

Intermediate certification of students is a procedure carried out during the examination session in order to assess the quality of students' mastering the content of part or the entire volume of an academic discipline after completing its study.

Knowledge is the result of the assimilation of information through learning and personal experience, a body of facts, principles, theory and practice relevant to the field of study or work, a component of a qualification that must be assessed.

Learning outcomes are competencies acquired in the process of formal and informal learning and confirmed and recognized upon receipt of qualifications. They are defined as knowledge, skills and competencies.

Midterm control is the control of students' academic achievements upon completion of a section (module) of one academic discipline.

Module is an educational component of the curriculum that is allocated when designing curricula, taking into account national qualification structures, level descriptors, qualification descriptors and with an assigned number of credits.

National Qualifications Framework is a systematic and structured description of the skill levels recognized in the labor market.

National Qualifications System is a set of mechanisms supporting the qualifications framework, including mechanisms for legal and institutional regulation of the demand for workers' qualifications from the labor market and the supply of qualifications from the education and training system.

Postrequisites are disciplines that require knowledge, skills and abilities acquired upon completion of studying this discipline.



Prerequisites are disciplines that contain knowledge, skills and abilities necessary for mastering the discipline being studied.

Profile of a specific training program is a description of the program in terms of its main functions and specific goals and the corresponding learning outcomes. Profile – specialization.

Qualification is an official recognition of value in the form of a diploma, certificate confirming that a person has competencies that meet the requirements for performing labor functions within a specific type of professional activity (requirements of a professional standard or requirements formed as a result of practice), formed in the process of education, training or work (on-the-job training), giving the right work activity.

Qualification level is a generalized set of requirements for the competencies of employees, differentiated by the parameters of knowledge, skills, complexity, non-standard work contexts, responsibility and independence, established and described in the qualifications framework

Skills – the ability to apply knowledge and demonstrate competence in order to carry out activities and solve problems (the use of logical, intuitive, creative and practical thinking).

Standard is a defining professional standard in a specific field of professional activity, requirements for the level of qualification, competence, content, quality and working conditions.

Training programs are a systematically organized package of activities, content and teaching methods that must be implemented

Working curriculum is a document developed and approved by the university on the basis of the standard curriculum of the SCES in the specialty and individual curricula of students, taking into account the conditions of a specific professional activity, the stages of the educational process. It contains a complete list of disciplines grouped into cycles of general, basic, professional indicating the minimum credits required for students to master, forms of control, as well as additional types of training and final certification. The structure of the working curriculum is determined by the university independently.



Abbreviations

AI - Academic Issues

AIC - agro-industrial complex

CED – Catalogue of Elective Disciplines

CLT – Credit Learning Technology

CTS – Credit Training System

DB – disciplines of the basic cycle

DCC – Disciplines of the Component of Choice (elective)

DGC – Disciplines of the General Cycle

DMC – Disciplines of the Mandatory Component

DP – Disciplines of the Profiling Cycle

EP - Educational Plan

EQF – European Qualification Framework

FSC – Final State Certification

IQF – Industry Qualifications Framework

IWS –Independent Work of Student

KazNARU - Kazakh National Agrarian Research University

KazPIPPQ - Kazakhstan Research Institute of Plant Protection and Quarantine

KEnEU - Kostanay Engineering and Economics University named after
M.Dulatov

LLP - Limited Liability Partnership

LO – Learning Outcomes

M – module

MA of RK - Ministry of Agriculture of the Republic of Kazakhstan

MEP – Main Educational Program

NQF – National Qualifications Framework

OHPE - Organization of Higher Professional Education



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RK – Republic of Kazakhstan

SCSE – The State Compulsory Standard of Education

ToU - Toraigyrov University

TS – Teaching Staff



1 Content, goals and objectives

The content of the educational program of higher education in agroecology with dual education provides for the study of a cycle of general education disciplines (DGC), a cycle of basic disciplines (DB), a cycle of profile disciplines (PD), as well as professional practice in relevant areas of training with a focus on learning outcomes and compliance with the national qualifications framework and industry qualifications framework.

The educational program "Agroecology" is based on a new model of on-the-job training, which will allow overcoming the structure, volume and quality of labor resources from the real needs of specific farms or enterprises with an innovative approach through dual training.

A new pedagogical approach based on dual higher education will allow agroecology students to acquire more relevant knowledge and skills, combining formal education with digital training received at the workplace in companies. The training results will be compatible with the requirements of agricultural companies. As a result, this will provide them with competencies that are more in line with the needs of companies, and they will be able to get a job more easily.

The activities of the EP are aimed at solving this problem:

at the systemic level – by providing support in the field of politics, industry and education in the development of a regulatory framework, national concepts and standards;

at the level of educational institutions and the AGROKAZ project, through the introduction of dual training into the curriculum at the higher education level, which combine academic teaching and on-the-job training, and are developed jointly with employers;

at the regional level, by facilitating regional exchange between partners in the three countries, as well as jointly developing common approaches and formats before implementing programs at the national or institutional levels.

Within the framework of the AGROKAZ project, a working group consisting of representatives of selected universities was formed to develop the Bachelor's degree program "Agroecology".

The purpose of the work was to develop a new type of curriculum, in a consortium of universities and employers/companies, in which practical experience in the workplace is an integral part of the academic program, curriculum and



syllabus. The stages of study at the university and at the workplace are related in time and content, and academic credits are awarded for structured work experience.

This approach was chosen in order to ensure that the training of future graduates meets modern requirements for resource-saving crop cultivation technologies, methods for obtaining high-quality crop products, effective methods for reproducing soil fertility and methods of agroecological monitoring. At the same time, the program has been developed in compliance with academic standards, which creates conditions for the academic development of the future graduate.

Another priority in the development process was to ensure that the educational program is properly aligned with the guidelines of the European Higher Education Area (EHEA) to ensure its international recognition and competitiveness, as well as opportunities for regional exchange and mobility.

Thus, the main goal of the educational program is to meet the needs of society for qualified personnel by training specialists in the field of agriculture and bioresources who are able to assess the environmental condition in modern conditions and reduce the impact of the growing man-made load on agricultural territories and the agro-industrial complex.

The Bachelor's degree program "Agroecology" offers practice-oriented training with a special focus on the food production sector, combined with systematic training at the enterprise, which is an integral part of the training.

The program prepares its future graduates for the management of agriculture and bioresources, as well as for work in the field of environmental protection, to ensure the sustainability of geographical patterns within the biosphere and to preserve environmental safety. Graduates will have the professional competencies of an environmental engineer, an agrometeorologist, an ecologist, a soil scientist, an ecologist, an agronomist who is able to work in administrative and managerial positions related to agro-industrial management at the level of low- and middle-level specialists with high potential for career growth.

The program is aimed at promoting and actively cooperating with relevant companies in the agricultural industry sector.

After successful completion of the program, the student will be able to:

- organize and introduce into production modern agrotechnical techniques for the cultivation of vegetable and fruit crops, taking into account the achievements of



science and production experiments, storage and processing of fruit and vegetable products and other household work;

- plan, organize and implement systems of agrotechnical measures for the breeding of new resistant varieties and hybrids of agricultural crops;
- conduct agrochemical analyses of nutrient solution, soil, substrate, plant analyses and application of mineral fertilizers, and maintaining an optimal agrochemical background that ensures normal growth, development and formation of a high-quality harvest of greenhouse crops;
- implement issues related to the control of harmful organisms in order to create an optimal phytosanitary condition of plantings;
- use biotechnological processes to obtain high-quality planting material;
- introduce new ecological methods and technologies for restoration of disturbed ecosystems and rational use of natural resources;
- possess independent academic, practical and learning skills for continuous professional development, including further education at the undergraduate level.

The Bachelor's degree program "Agroecology" is a 4-year (8 semesters) program with a total credit volume of 240 ECTS, characterized by a constant alternation of phases of theoretical education at the university and practical phases in the company, and modern, practice-oriented teaching.

Combining theory and practice is a top priority and represents one of the main features and benefits of the Bachelor's degree program.

The theoretical content is formed during the phase of study at the university, and then applied in practice. Due to regular training in companies, it is assumed that students never lose touch with practice and are always ready for new situations.

Upon graduation, students have broad practical knowledge in the field of agriculture and additional related business areas, can apply this knowledge in practice, and are familiar with various functions and activities of the company's departments, which allow them to be best prepared for the requirements of the labor market.

From the company's point of view, such training is also beneficial. Since students return to the same company over and over again during their studies, after graduation they have an established connection with the company, know all the relevant functions and processes in the company and, therefore, are already full-fledged employees of the company during or, at least, after graduation. This means



that the company no longer needs the time-consuming and lengthy stages of education and training that university graduates usually go through.

Basically, each semester consists of a university study phase and a practical phase. In general, the duration of both stages is approximately the same. When implementing the program at the national level, the following distribution is also possible: 60% at the university and 40% at the enterprise, but a further sharp reduction in the practical phase is undesirable, because otherwise the implementation of the basic idea of higher education and the integration of students into the enterprise processes may be difficult.

Admission to the program is carried out on an annual basis. There are modules at the university and modules in practice. While university modules are traditional modules that are taught at the university, practical modules take place during practical training at the workplace.

The main modules are modules of specialization related to the agricultural field, where students in the program must pass to gain knowledge and skills in the subject. If the basics of crop production are studied in the first semesters, then during further studies students master topics such as the introduction of new environmental methods and technologies for the restoration of disturbed ecosystems and environmental management, digital technologies in the agro-industrial complex and the design of global ecological systems.

In addition, in the fifth and eighth semesters, students can choose to study elective modules also related to the agro-industrial complex. Writing a thesis is also part of the core module.

Additional modules are modules that are required within the framework of the Bachelor's degree program in Agroecology to provide students with knowledge in the field of agriculture and other fields. These include: higher mathematics, economics, finance, management, law, etc. Since agriculture is linked to other business lines, such extensive knowledge is necessary to prepare students for their future responsibilities in practice.

General education modules are modules that are necessary for all bachelor's degree programs, regardless of the field of study, and which are determined on the basis of regulatory documents of each country. The total number of credits for general education modules is 56 ECTS.

Although the exact distribution is determined depending on the specific module, the goal of each module is to provide about 30% of the load on the contact



clock and about 70% for independent work. In addition, the entire curriculum and, consequently, most modules at the University are characterized by a high degree of practice-oriented training, including case study, group work and other teaching methods that ensure the achievement of higher education goals.

During the practical training, students also master practical modules. They are assisted in this by mentors both at the university and at enterprises. ECTS credits are awarded for completing practical modules, but completing practical modules is only one part of the practical phase. Most of the work during the practical phases includes work at enterprises, for which ECTS credits are not directly assigned, but this work partially counts towards the completion of practical modules.

During their studies at universities and enterprises, students are offered the following educational and methodological resources:

- educational resources: textbooks, local and international multimedia/online libraries, IT laboratory, Internet access, methodological manuals (reference book) for laboratory work, local and international online training resources, infrastructure and resources of the company during production practice;
- academic support for students: individual mentoring, scheduled meetings, interest clubs, international competitions and student exchange;
- support for students in enterprises: individual mentoring;
- other student support: for example, student clubs, sports complexes to ensure the physical and emotional well-being of students.

2 EP analysis in Kazakhstan

The management of the educational process in Kazakhstan includes a number of stages: constant analysis of the needs of the labor market, analysis of employment and questionnaires of stakeholders, formation of the necessary competencies of graduates based on the requirements of professional standards and requests of employers, formation of goals, content and structure of the educational program, selection of approaches to training and methods of assessing the quality of educational program implementation, further improvement of educational programs.

Educational programs are updated in connection with changes in the regulatory documents of the Ministry of Education and Higher Education of the Republic of Kazakhstan, the demands of the labor market and stakeholders. Also, taking into account the demand for specialists in the labor market and the ongoing



transformations in the country's economy, the university is opening new educational programs.

The development of educational programs in the field of agroecology was predetermined by intensive socio-economic changes, new priorities in the development of the education system and the country as a whole; fundamental changes in the system of higher and postgraduate education of the Republic of Kazakhstan.

The design and development of educational services in the Republic of Kazakhstan are carried out on the basis of: - input data – Dublin Descriptors, national qualifications framework, industry qualifications framework, professional standards, state mandatory education standards (SOSVO, SOSPO), other regulatory requirements and labor market requirements.

In general, the procedure for developing an educational program includes the following stages:

1. The study of Dublin Descriptors.
2. The study of the NQF, IQF, Professional standards, SOSE.
3. Study the requirements of the labor market to identify the main requirements for the content of modules and disciplines.
4. Identification of interdisciplinary correspondences for the formation of modules and competencies. Each module assumes uniqueness in the formation of the competencies of future specialists. The competencies being formed cannot be duplicated in other modules.
5. Involvement of teachers in order to make proposals for the formation of modules in accordance with the goals and objectives of the disciplines, indicating the results of the module's training, volume and duration.
6. The formation of the initial version of the educational program and the suggestions of teachers.
7. At the meeting of the Academic Committee (ToU), the Committee for the Development of EPs (KEnEU), the correctness of module composition, its effectiveness in the training of future specialists, compliance with the requirements for the formation of modular educational programmes established by CTE, GOSO Rules, etc. are analysed.
8. Based on the results of the analysis, adjustments are made to the initial version of the modules of the educational program.



9. General compulsory modules include disciplines of the compulsory component of the GCD cycle, are developed by the relevant special departments and are mandatory for all educational programs.

10. Compulsory modules in the educational program include compulsory disciplines (CD) of the BD and PD cycles, may include elective disciplines (ED), taking into account the specifics of the socio-economic development of the region and the needs of the labor market, established scientific schools.

11. Elective modules for a specific educational program consist of one or more options for learning paths or a set of modules (Minor) (the total amount of credits for each option should be the same, in terms of modules they may be different) depending on the individual interests of students.

3 Discussion with the main consumers

In the course of work on determining the needs of the market, business sectors and competencies in the national labor market, the main consumers of EP and stakeholders were identified:

- applicants for Bachelor's degree in the direction 6B08111 – Agroecology, focused on professional activity in the field of natural sciences;
- secondary vocational educational institutions;
- universities that train specialists in the profile 6B08111 – Agroecology;
- industrial and research enterprises of the region and the country.

The main tasks of the processes related to consumers are set:

- collection and analysis of marketing information about potential consumers of the service provided;
- attracting potential consumers;
- identify and meet the current and future needs and expectations of current and potential consumers.

The department conducts research to study potential consumers of the services provided, their requirements and assess the possibility of meeting these requirements.

Work with employers is conducted at KEnEU, ToU, KazNARU and at departments in the following areas:

- involvement of partner representatives in quality control of education by means of questionnaires, examination of educational institutions, participation in



graduate certification procedures (reviewing graduation papers, work in the Academy).

- providing a forecast of the need for specialists of the required level of professional competence in specific areas of education development in the region and the country;
- forecasting the need for the formation of a recruitment plan for the new academic year;
- development of cooperation with partners in the development and improvement of the content of educational programs (curricula and programs, the list and content of elective subjects);
- implementation of professional development programs for teaching staff and teaching staff of the University.

At the meetings of the department, the heads of the enterprise, the heads of the branch of the state institution "Republican Plant Quarantine Center" of the State Inspection Committee in the agro-industrial complex of the Ministry of Agriculture of the Republic of Kazakhstan, as well as the Deputy Chairman of the Board of LLP "Agricultural Experimental Station Zarechnoye", KazRIPPQ, etc., were invited. During the meeting, the problems and needs of Kazakhstan related to education in the field of agroecology.

All the heads of the enterprise within the framework of the consortium took part in the discussion of agricultural enterprises and professional competencies in the field of agroecology. The result of the meeting was a proposal for the development of an educational program.

The needs of the labor market and the competencies in the labor market of future bachelor of agroecology were discussed with representatives of the business communities at the annual regional agricultural fairs.

Ideas and prospects for the development of the educational program "Agroecology" were discussed at a meeting of academic committees, members of the committee for the development of educational programs in partner universities.

All potential employers were familiarised with the planned new Bachelor's degree courses presented in Table 1:



Table 1 - Developed new courses of Bachelor programme "Agroecology" by partner universities

Universities	New courses	Updated courses	Note (name corrections)
KEnEU new - 7 updated - 8	"Biogeochemistry and ecotoxicology", "Agroecology of microorganisms", "Ecological cartography and GIS", "Agroecological monitoring", "Technogenic systems and environmental risks", "Logistics of production processes in agriculture", "Technical regulation in agroecology"	Plant ecology, Economics and organisation of agricultural production, Environmentally safe technologies in agriculture, Mathematical modelling in agroecology, Fertilizer system, Agroecological assessment of lands, Regulatory and legal support and document flow in agroindustrial complex. Processing in agro-industrial complex.	Fertiliser application systems Waste recycling and utilisation in the agro-industrial complex
ToU new - 6 updated - 9	"Biogeocenology", "Soil remediation", "Ecological chemistry", "Fundamentals of environmental regulation and expertise", "Water protection", "Environmental protection and rational use of natural resources"	Fundamentals of Forestry, Phytopathology, Plant Protection, Agricultural Entomology, Biochemistry of Agricultural Plants, Agrochemistry, Inorganic and Analytical Chemistry, Agricultural Machinery and Technology, Irrigation and Crop	



		Reclamation.	
KazNARU new - 11 updated - 4	Fundamentals of Bioindication of Environmental Pollution, Nature Conservation, Rational Use and State Control, Geoinformation Systems in Ecology, Ecological Modelling of Agroecosystems, Agriculture and Environment, Agroclimatology, Agricultural Zoology, Environmental Ethics, Fundamentals of Agroecology, Soil Fertility Management, Agroecological Practice, Systems and Philosophy	Ecological Foundations of Sustainable Agriculture, Fundamentals of Agricultural Economics, Soil Microbiology and Biochemistry and Principles of Sustainable Development	

Employers emphasized that Professional Standards create the basis for educational institutions to create educational programs and develop courses. Through which the qualifications necessary for an employee to carry out a certain type of professional activity are characterized.

The characteristics of qualifications in the professional standard include, for each generalized work function corresponding to a certain level of qualification, a description of work functions, work actions, skills and knowledge, as well as possible job titles, educational requirements, practical work experience and special conditions for admission to work.

Most employers have proposed to change the planned new bachelor's degree courses in accordance with the Industry Qualification Framework and professional standards.



The wishes of students are determined by conducting a process of choosing individual educational trajectories, by means of questionnaires and surveys of students on issues of satisfaction with the educational program.

The wishes of the teachers in the construction of the EP are taken into account when discussing them at the meetings of the departments. All changes in the curriculum affect the contingent of students, the content of curricula and programs, and the structure of the teaching load.

The purpose of registering students for disciplines and teachers in three universities is to create conditions for maximum individualization of training and meeting the needs of the student in obtaining the necessary competencies within the framework of the studied modular educational program, taking into account the specifics of the socio-economic development of the region, the needs of the labor market and established scientific schools. Registration is regulated by the Rules of registration of students for disciplines and teachers at three universities.

In general, the content of both the educational program as a whole and each discipline individually is determined by the system of Dublin Descriptors.

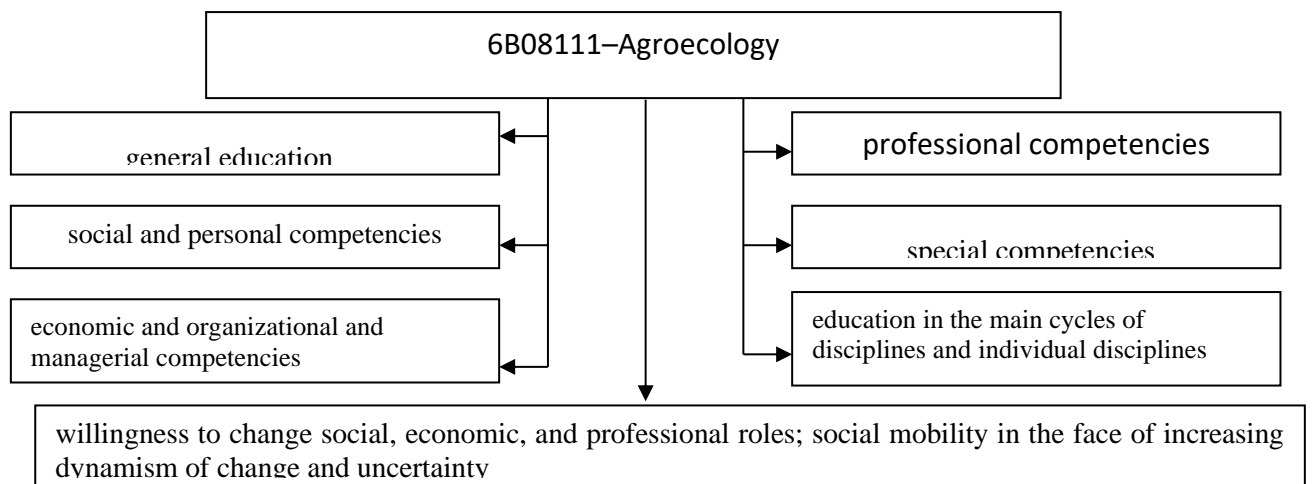


Figure 1 – Bachelor's competence model 6B08111–Agroecology

The educational program provides a balance between intellectual development and the development of managerial skills, professional and special competencies (Figure 1).



4 Development of LO

The goals of the educational program have been developed, which necessarily correspond to the level of development of science and reality so that they are presented as certain results, results that should be achieved within the specified time frame.

Taking into account the substantive and functional aspects of goal-setting, several goal-setting planning strategies were identified: the national hierarchy of educational goals, goal-setting at the graduate level, goal-setting in the educational field.

The national hierarchy of educational goals is a long-term strategy for transformations in the state education system and the formation of a national education model, which is reflected in the State Educational Standard of the Republic of Kazakhstan. The general tactical program for the implementation of a common long-term program is called goal setting at the graduate training level and will be reflected in the graduate's qualification characteristics.

The element-by-element mechanism of transition from a general long-term program and from a general tactical program to a systematic mechanism for planning the educational process is considered to be goal-setting in the educational field. They will be reflected in the educational and methodological complexes of the educational program. These goal-setting strategies can be presented in the form of a model that consists of several levels (Table 2).

Table 2 - Level goal setting model

The level model of educational and pedagogical goal-setting	The focus of goal-setting in the educational field
Global goal setting	Continuous multi-level education
National goal setting	Ensuring the high quality of special education. Ensuring the convertibility of higher education documents for the equal participation of the Republics of Kazakhstan in the educational space



The goals of education at the graduate level	Obtaining a full-fledged and high-quality professional education, professional competencies in various fields of agriculture and related disciplines
Goal setting in the educational field	Mastering the knowledge of humanitarian disciplines, ethical legal norms regulating the attitude of a person to a person, society, the environment, culture of thinking and the ability to organize their work on a scientific basis.
Goal setting in the real learning process	Mastering the scientific foundations of labor organization, computer technologies used in professional activities; mastering the system of knowledge and skills that ensure the preservation of health, development and improvement of physical abilities

The composition of the goals of specific educational programs is determined by the direction and level of training: programs of higher professional education (Bachelor's degree) (Table 3).

Table 3 - Hierarchy of purposes of the educational program 6B08111– Agroecology (ToU)

Purposes
The main national purposes of education in accordance with the Concept of the development of the education system of the Republic of Kazakhstan are to satisfy the interests of society, the state and the individual in obtaining high-quality higher education, providing everyone with ample opportunities in choosing the content, form and duration of education.



<p>The purpose of undergraduate education (basic education) is to provide broad basic professional training aimed at achieving the fundamental nature of the subject knowledge of future specialists. Providing a bachelor with a general integrated methodology of professional activity, developing professional creativity skills among future specialists, and creating a need for further improvement of the educational level.</p>
<p>The purpose of the educational program is to train farmers capable of carrying out agroecological activities that ensure food security in the agricultural sector based on the rational use of biological resources.</p>
<p>The purpose of the cycle of general education disciplines is to train a specialist of a new formation with broad fundamental knowledge, proactive, adaptive to the changing demands of the labor market and technology, able to work in a team. Providing conditions for the acquisition of a high general intellectual level of development</p>
<p>The purpose of the cycle of basic disciplines is to form a set of fundamental knowledge on general education and practice-oriented knowledge in the professional field; to train a specialist with the necessary knowledge in the field of agroecology. Creating conditions for the development of creativity, initiative and innovation.</p>
<p>The purpose of the cycle of core disciplines is to complete the fundamental training of bachelors in the specialty and improve professional competence. Preparation of a specialist for creative, active professional and social activities, high-quality performance of practical tasks in conditions of uncertainty and risk. Improving the competitiveness and mobility of graduates in the market of certified specialists of the region and the Republic of Kazakhstan.</p>
<p>Academic objectives are reflected in syllabuses</p>

The purposes of EP 6B08111–Agroecology are formulated taking into account the requirements and requests of potential consumers, and based on the assessment of the demand for EP, which is determined by the interests of potential employers, applicants, the potential of the university, the requirements of the state and society. Therefore, the proposals of potential employers, students, etc. are taken into account when developing.

The purposes of 6B08111–Agroecology define the main tasks that implement the functions of the educational process.



So Purpose 1 is implemented in the following tasks:

mastering the system of scientific concepts, theoretical and methodological categories of basic and professional disciplines, definitions of the categorical apparatus of scientific research;

formation of skills to apply modern research methods in agriculture

development of the ability to participate in the development and testing of new technological systems, tools and methods designed to solve professional problems in agro-industrial and agriculture.

Purpose 2 defines the following tasks:

formation of special competencies for the organization and management of the activities of the workforce, students, etc.;

formation of competencies for choosing target and semantic attitudes for their actions and deeds, to be able to make decisions.

possesses the skills necessary for critical thinking, observation, the ability to interpret, analyze, draw conclusions, and the ability to give estimates;

has the quality of creativity (creativity): the ability to move from one aspect to another, the ability to put forward ideas that differ from the obvious ones,

social, generally accepted, banal or firmly established, the ability to see the essence of the problem, the ability to resist stereotypes;

understands and is able to lead an active life position, can carry out independent behavior towards other individuals, strive to lead in a group, a team, without harming them and within the framework of regulatory regulations;

He is able to work in a team, correctly defend his point of view, offer new solutions, and is able to adequately navigate various social situations.

Purpose 3 is implemented in the following tasks:

formation of special competencies for the organization of professional activities for planning and conducting agronomic, agroecological events;

meeting the needs of employers for qualified specialists;

Purpose 4 is implemented in the following tasks:

formation of competencies related to project development, development of the ability to turn ideas into actions, plan and manage projects to achieve professional goals, understands ethical values; development of the ability to work with people,



knowledge in the field of interaction with customers, personnel management, interaction with users, work with authorizing and authorized bodies, work with government representatives; knowledge of the basics of the legal system and legislation of Kazakhstan, trends in the social development of society.

formation of subject competencies for the development of projects of agricultural facilities;

Purpose 5 is implemented in the following tasks:

formation of professional competencies in the management of a group of employees with taking responsibility for the result of their actions at the site of the technological process; training in the ability to develop, implement, control, evaluate and adjust the components of the agrotechnological process;

formation of professional competencies for planning and conducting agricultural activities aimed at rational, permanent, sustainable use of land, increasing crop productivity, preserving environmental, water protection, protective, sanitary, hygienic, health and other useful functions of nature.

the ability to carry out production and technological activities related to the cultivation of crops using intensive or resource-saving technology and the organization of labor in crop production and other agricultural work;

Purpose 6 is implemented in the following tasks:

meeting the needs of the individual in intellectual, cultural and moral development through higher professional education;

mastering the methods of physical, spiritual and intellectual self-development, emotional self-regulation and self-support.

The concept of the program structure should be built in combination with a combination of individual modules, taking into account the formulated goals, forms of learning and teaching.

The purposes of the educational program necessarily correspond to the level of development of science and reality so that they are presented as certain results, results that should be achieved within the specified time frame.

In accordance with this model, the educational programs of the specialty realize the goals of the State Mandatory standard of Higher Education and the mission of the department.



To achieve this goal, the Bachelor of specialty 6B08111–Agroecology masters the following key competencies, taking into account the qualification requirements:

Generated learning outcomes according to EP 6B08111 Agroecology

The following LOs have been formed at KEnEU:

ON1 Capable of communicating in a global and diverse professional community, expressing his/her own opinion in a reasoned manner orally and in writing in the state, Russian and foreign languages in accordance with the regulatory and legal framework, using digital technologies

ON2 Capable of reasonably making optimal decisions in the field of agroecology, analysing alternatives, showing personal initiative and responsibility, priorities of healthy lifestyle and life safety

ON3 Capable of managing agroecology projects in a variety of team roles, drawing on project management methodologies and science, financial literacy and entrepreneurial skills, regulatory compliance and anti-corruption

ON4 Capable of conducting agro-ecological data analysis, applying mapping, mathematical modelling and systems analysis methods, interpreting and visualising data

ON5 Capable of conducting complex ecological expertise of agricultural lands, understanding the peculiarities of the structure, their swarms in the biosphere, weather and climatic conditions, determining their interrelations in agro-ecosystems, using resource-saving cultivation technologies with the use of agricultural machinery and equipment

ON6 Capable of rationally using agricultural land, increasing soil fertility, replenishing the deficit of chemical components for growth and development of crop yields, analysing biochemical processes, properties and transformations of chemical elements, compounds and managing their permissible norms

ON7 Capable of justifying the selection of varieties, sowing technologies, methods of crop protection using innovative technologies in different agrolandscape and environmental conditions

ON8 Capable of monitoring and evaluating land used in agro-industrial complex, determining physico-chemical and biological characteristics of soil with the impact of toxic substances on it and the role of microorganisms in the soil formation process

ON9 Capable of identifying the negative impact of man-made systems on the environment, managing environmental risks and safe technologies for effective technical regulation in the agro-ecology system



ON10 Make decisions on effective project management in the agro-industrial complex, taking into account the regulatory framework, sectoral economic efficiency and logistics of the movement of agricultural commodities

KazNARU has formed the following LOs:

ON 1 socio-economic, legal, moral and ethical aspects and functions of anti-corruption culture, understand the meaning of the principles of academic integrity.

ON2 Apply the level of knowledge and understanding of scientific picture of facts, theories based on the provisions, laws of mathematics, economics and biophysics, ensuring ecological attitude to the environment, compliance with norms and standards in the field of occupational health and safety.

ON3 Collect and interpret information on the diversity of cultivated plants, their botanical, physiological and economic features, as well as an understanding of the complex impact of environmental factors on plant organisms, study technological methods of cultivation of agricultural crops.

ON4 Apply theoretical and practical knowledge to solve integrated plant protection, methods of control and optimisation of phytosanitary condition of crop areas aimed at yield and quality of products.

ON5 Apply theoretical and practical knowledge of climatic conditions, soils, fertilisers, tillage methods and technologies for using agricultural machinery and implements, and observing the state of protection of ecosystems.

ON6 Apply knowledge and understanding at a professional level and solve problems in field work to improve crop fertility and productivity, soil fertility conservation and reproduction measures, and environmental parameters of land suitability for crop cultivation.

ON7 Know the methods of scientific research and apply the knowledge to use soil maps, agrochemical cartograms and GIS technologies in intensive farming, soil science, ecology, in order to assess soil fertility and methods of its restoration.

ON8 Apply methods of principles of rational use of limited resources, monitoring studies and analyses of physico-chemical indicators of atmospheric air, soil and water ecosystems.

ON9 Understand the significance of and measures to prevent the depletion and pollution of soil resources, biogeochemical assessment of natural and anthropogenic landscapes, regulatory requirements and environmental safety.

ON10 Demonstrate knowledge and understanding of; standard environmental monitoring techniques, phytoindication research methods, and soil ecological data processing.



5 Information about the disciplines of the educational programme

As a result of mastering the bachelor's degree program, the graduate must: general cultural, general professional and professional competencies should be formed.

A graduate who has completed Bachelor's degree program must have the following **general cultural competencies**:

The ability to use the fundamentals of philosophical knowledge to form a worldview position;

The ability to analyze the main stages and patterns of the historical development of society in order to form a civic position ;

The ability to use the basics of economic knowledge in various spheres of life ;

The ability to use the basics of legal knowledge in various spheres of life;

The ability to communicate orally and in writing in Russian, Kazakh and foreign languages to solve problems of interpersonal and intercultural interaction;

The ability to work in a team, to perceive social, ethnic, confessional and cultural differences with tolerance;

The ability to self-organize and self-educate;

The ability to use methods and means of physical culture to ensure full-fledged social and professional activities;

The ability to use first aid techniques, methods of protection in emergency situations.

A graduate who has completed Bachelor's degree program must have the following **general professional competencies**:

The ability to solve standard tasks of professional activity on the basis of information and bibliographic culture with the use of information and communication technologies and taking into account the basic requirements of information security;

The ability to use the basic laws of natural sciences in professional activities, to apply methods of mathematical analysis;

The ability to landscape analysis of territories;

The ability to recognize the main types of soils, assess the level of their fertility, and justify the directions of soil use in agriculture;

Willingness to conduct physical, physico-chemical, chemical and microbiological analysis of soils, plants, fertilizers and meliorants.

A graduate who has completed Bachelor's degree program must have **professional** competencies:



Willingness to participate in conducting soil, agrochemical and agroecological surveys of lands;

the ability to make soil, agroecological and agrochemical maps and cartograms;

the ability to optimize the water regime of plants on reclaimed lands;

the ability to assess and group lands according to their suitability for crops;

the ability to justify the rational use of technological techniques for the reproduction of soil fertility;

willingness to draw up crop rotation schemes, soil tillage and plant protection systems, to justify environmentally safe crop cultivation technologies;

the ability to analyze and evaluate the quality of agricultural products;

the ability to carry out plant and soil diagnostics, take measures to optimize the mineral nutrition of plants;

the ability to conduct an environmental assessment of agricultural facilities;

the ability to organize the work of performers, to find and make managerial decisions in the field of organization and rationing of labor in different economic and business conditions;

the ability to determine the economic efficiency of the use of fertilizers, chemical means of land reclamation and technological methods of cultivation of agricultural crops;

the ability to conduct marketing research in the markets of agrochemicals and agricultural products;

willingness to cooperate with colleagues and work in a team of various organizational forms of ownership;

the ability to conduct soil, agrochemical and agroecological research;

the ability to generalize and statistically process the results of experiments, formulate conclusions.

The implementation of EP 6B08111–Agroecology is carried out in accordance with the mission of partner universities, which determines the specifics of the program, the characteristics of groups of students and the educational results they receive.

The targets of the adopted mission correspond to the main objectives of the national education system of the Republic of Kazakhstan until 2050.

The objectives of the EP are characterized by concreteness, clarity and completeness. These goals clearly state the requirements for the level of preparedness of a graduate specialist. They correspond to the types of professional activity of the Bachelor of EP 6B08111–Agroecology.

The purposes for the development of EP 6B08111–Agroecology are:



- the development of science and technology through scientific research of scientific and pedagogical workers and students, the use of the results obtained in the educational process;
- satisfaction of the needs of the individual in cultural, moral and intellectual development, through higher professional education;
- meeting the needs of employers (feedback on the EP) in qualified specialists, and highly qualified scientific and pedagogical personnel;
- organization and conduct of fundamental and scientific research;
- training of personnel with higher professional education;
- preservation and enhancement of moral, cultural and scientific values of society, patriotic education of youth.

The main consumers of EP and stakeholders are:

- applicants for Bachelor's degree in the direction 6B08111 – Agroecology, focused on professional activity in the field of natural sciences;
- secondary vocational educational institutions;
- universities that train specialists in the profile 6B08111–Agroecology;
- industrial and research enterprises of the region and the country.

The main tasks of consumer-related processes are:

- collection and analysis of marketing information about potential consumers of the service provided;
- attracting potential consumers;
- identify and meet the current and future needs and expectations of current and potential consumers.

The requirements set by consumers are stipulated in the WC of the specialty or areas of training in terms of the university component, elective courses or individual student training plans.

After determining the requirements of consumers, the following are established: the most important indicators of the quality of services for consumers in their opinion; the levels of indicators expected by consumers that characterize these services; consumer perceptions of this service.

The requirements of consumers are reflected in the following documents: WC of specialty and areas of training; catalogs of elective disciplines (hereinafter referred to as CED); individual student training plans; contracts for training; work curricula of disciplines; contracts and agreements on joint activities concluded with enterprises.

The department conducts research to study potential consumers of the services provided, their requirements and assess the possibility of meeting these



requirements. Based on the analysis of the information received, the interests of potential customers are taken into account.

To keep in touch with potential consumers, the following are conducted: periodic consumer surveys, open days; advertising and information work using communication resources, mass media, participation in exhibitions, conferences, seminars; reception by the rector on personal issues; holding fairs for student employment with the invitation of heads of enterprises, firms, companies. The information received is communicated to all persons and departments who need it in order to identify ways to improve and further improve their work.

The formation of professional and special competencies is the first direction of the competence-based approach to modern education. In 6B08111–Agroecology is represented by two groups of disciplines: 1) disciplines that are mandatory for study, forming a general professional competence (B); 2) disciplines of the student's choice, forming a special and additional competence (C).

The professional competence of an agricultural specialist of a new formation is understood as an integrative personality quality characterized by the desire to master a profession, the presence of theoretical knowledge and practical skills in the field of forestry, allowing him to freely solve professional tasks. Competencies involve the training of a specialist through the implementation of the content of the State Mandatory Standard of Higher Education and the national qualification framework; the development of interdisciplinary knowledge and skills, including in other natural sciences; information, economic, communicative and legal training.

The formation of each of the components of professional readiness is characterized by the results of graduate training not in each discipline, but in the cycle of disciplines as a whole, which requires strengthening interdisciplinary ties and contributes to the interdisciplinary transfer of knowledge. One of the ways to solve this problem is integration in the field of academic disciplines based on the consideration of interdisciplinary tasks of an applied nature.

An example of the implementation of such a path in 6B08111–Agroecology is the integrated interdisciplinary modules that form entrepreneurial skills ("Socio-political knowledge and leadership", "Entrepreneurship Module (major)") developing trilingualism ("Information and Communication module")

The second direction is the formation of generalized subject competencies. Generalized subject competencies are responsible for the ability to use the content of various disciplines in solving specific tasks. In a certain sense, this trend is associated with the trend towards the universalization of education. At the same time, the horizons of students expand, the skills to search and find non-standard solutions to problems arising in professional activity and everyday life are formed. It



is necessary for the student to understand the essence and vision of the connection of the course with the phenomena of reality. In order to penetrate into the processes (phenomena) under study and manage them, a future specialist should be able to find the appropriate mathematical apparatus that could provide a more accurate and logically rigorous method of analysis, choose alternative hypotheses correctly, and use modern IT technologies.

The third direction of the competence approach is to strengthen the practical, applied nature of education – the development of applied subject competencies. Applied subject competencies are related to the activity-based nature of professional training. In contrast to generalized subject competencies, in this case, the ability to effectively use specific knowledge and skills in the studied disciplines in professional activity is formed. This area is a development of the traditional education system. To this end, in accordance with the university's governing documents, the practical component of bachelor's degree training was strengthened: types of practice were established, the number of credits for each type of practice was fixed, and forms of control were established.

The fourth direction is mastering life skills. The development of this area involves preparation for social adaptation, which is no less important than vocational training. Students develop competencies in the household, cultural and leisure sphere, for example, knowledge of effective ways to organize their free time. This also includes the experience of mastering the human worldview, expanding to a culturological and universal understanding of the world. Life skills are important for a professional to successfully socialize in society.

Rules for the establishment of three cycles and groups of disciplines. The educational program of the specialty and the curriculum establish three cycles of academic disciplines, and in each cycle – three groups of academic disciplines. The criterion for their establishment is the degree of commitment and the degree of consistency of assimilation of the content of the educational program of the bachelor's degree.

Each cycle of disciplines consists of three components: a mandatory component, university component and an optional component. The content of the mandatory component of the basic bachelor's degree provides graduate training in accordance with the academic degree. The content of the elective disciplines ensures that the graduate is trained in accordance with the basic competencies established by the national qualification framework and the Professional Standard.

Within each component, three groups of disciplines are distinguished, as a result of the assimilation of which key competencies of different levels of readiness are formed: disciplines of group A ensure the assimilation of the content of the



educational program of a generally mandatory level; disciplines of group B – professional readiness to work in the industry; disciplines of group C – scientific and practical readiness to work in the specialty.

The rules for determining the complexity of the curriculum consist of two parts: determining the complexity of the invariant part of the curriculum; determining the complexity of the variable part of the curriculum.

The ratio between the academic disciplines of the variable part of the curriculum is not fixed in the basic curriculum. This condition allows you to have a different ratio between the number of disciplines and credits allocated for the implementation of the educational program according to the module. The curriculum includes three groups of disciplines, the complexity of which can be presented as follows (Table 4).

Table 4 – The rate of distribution of credits for Bachelor's degree in the specialty 6B08111–Agroecology (duration of study 4 years) by cycles, components and types of disciplines (approximate version) type of disciplines A/B/C of ToU

The cycle of disciplines	Type of disciplines	Number of ECTS credits	Number of disciplines	Term	The percentage of credits by	
					cycles of disciplines	types of disciplines
DGC 1	A	56	11	1-4	21%	
DGC DMC 1.1	A	51	10	1-4		
DGC DCC 1.1	B,C	5	1	1--4		
DB 2		104			40%	
DB UC (university component)	A	58	11	1-5		56%
DB UC (university component)	B,C	36	16	4-7		39%
DB DCC (component)	B,C	5	1	7		



of the student's choice)						
Practice		5		2.4		4%
PD 3		90			35%	
PD DCC	A	11	2	5.6		12%
PD DCC	B,C	50	11	5-8		56
Practice		29		5,6,7		32%
Final certification (Writing and defending a thesis)		8			4%	
The total is		258	50		100%	

To achieve the goal of the project, a characteristic of the professional activity of the Educational program 6B08111-Agroecology has been developed.

The distribution of the volume of disbursed credits by module at KEnEU is presented in Table 5.

Table 5 - Summary table reflecting the volume of mastered credits in the context of modules for students on the educational programme of KEnEU

Year of study	Semester	Number of disciplines studied			Number of academic credits					Total hours	Number of	
		DMC	UC	DCC	Theoretical education	Physical education	Professional practice	Final attestation	Total		exams	diff. credit



1	1	5	1	5	28	2	-	-	30	900	7	-
	2	5	3	-	27	2	1	-	30	900	7	1
2	3	2	5	-	28	2	-	-	30	900	7	-
	4	1	5	2	25	2	3	-	30	900	6	1
3	5	-	6	-	30	-	-	-	30	900	6	-
	6	-	6	2	30	-	3	-	33	990	6	1
4	7	-	6	2	30	-	-	-	30	900	7	-
	8	-	2	-	-	-	22	8	30	900	-	2
Total		13	34	11	198	8	29	8	243	7290	46	5

The volume of disbursed credits at KazNARU is presented in Table 6.

Table 6 - Volume of disbursed credits of KazNARU

Year of study	Semester	Number of disciplines studied			Number of academic credits					Total hours	Number of	
		D M C	UC	DC C	Theoretical education	Physical education	Professional practice	Final attestation	Total		exams	diff. credit
1	1	3	3	-	25	2	-	-	27	810	6	-
	2	5	1	-	29	2	2	-	33	990	6	-
2	3	1	4	1	25	2	-	-	27	810	6	-
	4	3	3	-	26	2	5	-	33	990	6	-
3	5	-	5	1	31	-	-	-	31	930	6	-
	6	-	4	1	25	-	5	-	30	900	5	-
4	7	-	4	1	30	-	-	-	30	900	5	-
	8	-	3	20	-	-	5	8	33	990	-	-
Total		12	27	24	191	8	17	8	244	7320	40	-

In accordance with the competences, the educational programme has six types of modules:

These modules include disciplines of the DGC of the typical curriculum of the speciality and form systemic, general cultural competences of the students of the educational programme 6B08147-Agroecology. Table 6.



**Table 6 - General compulsory modules of the educational programme
6B08147-Agroecology of ToU**

Module (ECTS)	Forming competences	Disciplines included in the module
socio-political knowledge and leadership (18)	demonstrate leadership qualities on the basis of ideas of citizenship and patriotism, modernization of public consciousness-Rukhani Zhangyru, the third modernization of Kazakhstan when organizing and participating in university, regional and national level events.	History of Kazakhstan, Philosophy, Sociology, Psychology, Political Science, Cultural Studies
Information and communications (25)	demonstrate mastery of basic communication skills in the state, Russian and foreign languages (level A2, B1, B2), including in the professional sphere; - demonstrate mastery of information and communication technologies to organize work and solve standard professional tasks	Kazakh/Russian language, Foreign language, Professional (Russian) Kazakh language, Professionally oriented foreign language, Information and communication technologies

General compulsory modules - educational components of basic disciplines, forming the basis of the speciality and realized requirements for professional communicative and general professional (basic) competences. These modules include disciplines of the DB cycle of the typical curriculum of the speciality and form information and communication competences.

The general compulsory modules include groups of basic disciplines that form the core of the relevant science and form the basis of the qualification characteristics of a specialist.

The formula for determining the volume of educational content for these modules is knowledge and understanding, application of knowledge and understanding, acquisition and expansion of knowledge. The name of the module is determined by the scientific branch. Table 7

**Table 7 - Common compulsory modules of the basic disciplines of the
educational programme 6B08147-Agroecology of ToU**

Module (ECTS)	Forming competences	Disciplines included in the module
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<p>Scientific and Natural Sciences Module (14)</p>	<ul style="list-style-type: none"> - know the main classes and species of lower and higher plants, their structure and diversity; - know and understand the structure of cells and tissues of living organisms, their functions and importance; - be able to orientate to the classes of inorganic compounds, in chemical reactions occurring in a living cell; - to apply methods of agroclimatic forecasts and improve forms of agrometeorological support of agriculture; -be able to give agroclimatic substantiation of agrotechnical methods for the most complete and rational use of climate resources; - consolidation of the obtained theoretical knowledge in practice. 	<p>Inorganic and organic chemistry, Mathematics, Biology and systematics of agricultural plants</p>
<p>Technical service of land use (15)</p>	<ul style="list-style-type: none"> - be able to identify the main natural factors affecting the use of land in agriculture; - know types and forms of land management; - know types of agricultural machines and tools, their principle of operation and impact on soil cover; - know the main types of soils, their physical, mechanical and other properties; - be able to determine soil appraisal, soil structure and profile structure. 	<p>Land management, Agroengineering, Soil science</p>

Compulsory modules on speciality - educational components of profiling disciplines, forming subject-specific competences taking into account the profile of training in the research field, in the pedagogical field, in applied activity, in project activity, in organizational and managerial activity.

Within the framework of the Bachelor's degree programme, they include disciplines of the component of basic and major disciplines. The formula for determining the volume of educational content for these modules is knowledge and understanding, application of knowledge and understanding, acquisition and deepening of knowledge (Table 8).

Table 8 - Compulsory modules in the speciality 6B08147-Agroecology of ToU

Module (ECTS)	Forming competences	Disciplines included in the module
Production technology	- know and take into account in their work the laws of agriculture; factors of plant life and their regulation;	Farming, Crop production,



module (32)	<ul style="list-style-type: none"> - apply methods of reproduction and improvement of soil fertility; - have knowledge of morphology and biology of field crops; - be able to apply the acquired knowledge and skills in drawing up technological maps of cultivation of field crops; - know the basics of storage and processing of plant products; - be able to orientate in modern methods of storage and processing of production; - consolidation of the received theoretical knowledge in practice. 	Technology of storage and processing of crop products, System of fertiliser application in agriculture and production-technological calculations in agronomy (Project 1).
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Elective modules for a certain specialization are blocks of disciplines for individual profiling, forming possible competences within the specialization. The formula for determining the volume of education content for these modules is knowledge and understanding, application of knowledge and understanding, formation of knowledge, for which there is a long-time demand from consumers of educational services.

At Kostanay Engineering and Economics University and Toraigyrov University to meet the demands of the employer there is a purposeful work on the study of module (miner) on entrepreneurship. In the educational programme introduced micro qualifications at the choice of the student "Seed breeder-aprobator" and "Phytosanitary, agrophipatologist and entomologist". Mastering of micro qualifications gives the opportunity to obtain additional qualification corresponding to level 4 of the national qualification framework (vocational education (middle level specialist) (Table 9).

Table 9 - Elective modules in the educational programme 6B08147- Agroecology of ToU

Module (ECTS)	Forming competences	Disciplines included in the module
Speciality modules for the educational programme "Field production with the basics of GIS-technologies"		
Seed breeder-aprobator (elective microqualification) (15)	<ul style="list-style-type: none"> - know morphology and biology of seeds, agrotechnical conditions for obtaining high quality seeds; - have knowledge in the field 	Plant Genetics, Seed and Variety Control, Regulatory and legal acts on seed production, Technology of high quality seed production



	<p>of plant crossing, selection of genetic material;</p> <ul style="list-style-type: none"> - possess the basics of seed production of field crops; - understand the essence of selection process and creation of new varieties; - be able to apply breeding methods in professional activity. 	
Phytosanitary, agrophytologist and entomologist (microqualification) (11)	<p>know the main types of diseases, pests, weeds, their morphology and biology;</p> <ul style="list-style-type: none"> - be able to properly plan and carry out protective measures against pests, diseases and weeds of agricultural crops; - be aware of the application of chemical means of defence and the damage they cause to the environment; - know the methods and terms of application of protection means, ecological thresholds of harmfulness; 	<p>Protection of agricultural crops against diseases and pests, Protection of agricultural crops against diseases and pests</p>

The restructuring of the ideology of the educational programme development contributed to the introduction of practice-oriented educational modules in the educational programme 6B08147-Agroecology (Table 10)

Table 10 - Elective modules in the educational programme 6B08147-Agroecology of ToU

Module (ECTS)	Forming competences	Disciplines included in the module
Speciality modules for the educational programme "Field production with the basics of GIS-technologies"		
Agroecology and energy culture (15)	<p>know and understand: basic properties and structure of agroecosystems and their differences from natural ecosystems; centres and foci of origin of cultivated plants; role of cultivated plants and their companions in the structure of agroecosystems;</p> <p>basic principles of rational nature management,</p>	<p>Anthropogenic ecology, Ecological safety of agricultural products, Resource-saving and organic farming</p>



	<p>optimisation of agricultural landscapes and nature protection; basic legislative acts regulating the activities of industrial enterprises in the field of soil protection, land reclamation and waste management; basic principles of environmental management, agricultural landscape optimisation and nature protection; basic legislative acts regulating the activities of industrial enterprises in the field of soil protection, land reclamation and waste management wastes;</p> <p>be able to assess the impact of industrial enterprises on soil condition; justify potential opportunities to change the technological process in order to use waste as a secondary raw material;</p> <p>orientate in biological, ecological and environmental literature</p> <p>apply the system of knowledge on biology and ecology of different species of living organisms to plan environmental protection measures</p>	
<p>Restoration of disturbed agro-landscapes (10)</p>	<p>As a result of studying the discipline, the student should:</p> <p>know and understand: basic properties and structure of agroecosystems and their differences from natural ecosystems; centres and foci of origin of cultivated plants; the role of cultivated plants and their companions in the structure of agroecosystems; origin of farm animals and their influence on natural and artificial ecosystems; factors of soil formation and basic properties of soil as the basis of agrobiogeocenosis; basic principles of rational nature management, optimization of agricultural landscapes and nature protection; basic legislative acts, regulating wastes;</p> <p>be able to actively apply in practice the basics of knowledge about biological systems;</p> <p>be able to assess the impact of industrial enterprises on the state of soils; justify potential opportunities to change the technological process in order to use waste as a secondary raw material;</p> <p>correctly choose a method of reducing the volume of industrial waste and a method of its</p>	<p>Water resources and irrigation technologies in agriculture, Agromelioration and reclamation of disturbed lands</p>



	<p>utilization; be able to estimate the cost of damage from environmental pollution and the cost of all possible solutions to prevent damage; orientate in biological, ecological and environmental literature;</p> <p>apply the system of knowledge on biology and ecology of different species of living organisms for planning of environmental protection measures.</p>	
Ecologisation of agriculture (10)	<p>Know and understand: types of environmental activities; principles and rules of environmental protection; regulatory documentation on environmental protection; environmental quality standards; principles of environmental expertise, environmental audit; peculiarities of assessing the impact of planned economic activities on the environment; understand and apply;</p> <p>basic principles and the most promising ways of preventing negative environmental consequences of project implementation;</p> <p>laws of the Republic of Kazakhstan in the field of environmental expertise and environmental protection;</p> <p>means of environmental quality control;</p> <p>be able to assess the impact of various activities on the environment using norms and rules, regulatory documentation, environmental quality standards;</p> <p>to assess the quality of the environment by means of instrumental control,</p> <p>to make a correct choice of the method of reducing the volume of production waste and the method of its utilization; to be able to estimate the cost of damage from environmental pollution and the cost of all possible solutions to prevent damage;</p>	<p>Agricultural waste recycling and utilisation and biofertiliser production, Environmental monitoring and analytical techniques in agriculture</p>

Modules presented in the educational programme 6B08147 Agroecology developed by KEnEU are indicated in Table 11.



Table 11 - Content of the educational programme

Module name	Module Learning Outcome	Amount in academic credits	Module components					
			Discipline cycle and component	Discipline code	Name of discipline	Number of credits	Year of study	Form of control
Socio-political knowledge module	The learning outcome of the module of socio-political knowledge is aimed at forming in students a comprehensive socio-humanitarian worldview, the ability to analyze and evaluate social, political and cultural phenomena, as well as to use the acquired knowledge in solving applied problems and in communication in various spheres	18	DGC DMC	PC 1102	Psychology. Cultural studies	4	1	Exam
				ICT 1106	Information and communication technologies	5	2	Exam
				P 1107	Political Science. Sociology	4	2	Exam
				F 2108	Philosophy	5	3	Exam
Language	The module's Language Learning Outcome aims to develop students' competence in language, including understanding, using and analysing language structures, and the ability to communicate effectively and apply language knowledge in a variety of contexts.	20		FL 1103 (1)	Foreign language	5	1	Exam
				KRL 1104(1)	Kazakh (Russian) language	5	1	Exam
				FL 1103(2)	Foreign language	5	2	Exam
				KRL 1104(2)	Kazakh (Russian) language	5	2	Exam
Social communication and physical education	The learning outcomes of the general disciplines module are aimed at the formation of a set of knowledge and skills for personal development, social responsibility and professional competence.	18		HK 1101	History of Kazakhstan	5	1	State exam
				PE 1105 (1,2,3,4)	Physical Education	2	1	Exam
			2			2		
			2			3		
			2			4		
			DGC DMC	EBZh 1109	Ecology and life safety	5	1	Exam
FLAC1109	Fundamentals of law and anti-corruption							



					culture			
				FEE 1109	Fundamentals of economics and entrepreneurship			
				FSR 1109	Fundamentals of scientific research			
				FFL 1109	Fundamentals of financial literacy			
Natural and mathematical sciences	Module learning outcomes include an advanced understanding of biological systematics of crops, mastery of the fundamentals of organic, inorganic and analytical chemistry, and acquisition of knowledge of plant ecology. Learners also develop their skills in higher mathematics, enabling them to apply an analytical approach to biogeochemical and ecotoxicological problems.	21	BD UC	BSAC 1201	Biology and systematics of agricultural crops	4	1	Exam
				OIAC 1214	Organic, inorganic and analytical chemistry	5	2	Exam
				PE 1202	Plant ecology	3	2	Exam
				HM 2217	Higher mathematics	4	3	Exam
				BE 3219	Biogeochemistry and ecotoxicology	5	6	Exam
				B 3218	Biogeocoenology	5	5	Exam
				EC 3211	Environmental chemistry	5	5	Exam
				EP 1215	Educational practice	1	2	Pass
Farming and soil fertility management	The learning outcomes of the Agriculture and Soil Fertility Management module include a thorough understanding of the fundamentals of soil science, agronomy and soil diagnostics. Students acquire knowledge of	25	BD UC	SS 2203	Soil Science	5	3	Exam
				A-3212	Agrochemistry	5	5	
				F 2208	Farming	5	4	Exam
			BD UC	SD 2207	Soil diagnostics	5	4	Exam
				A 2207	Agrometeorology			
				FAS 3303	Fertilizer application systems	5	6	Exam



	agrometeorology and fertiliser application systems, enabling them to effectively manage soil fertility and develop optimal farming strategies.			SFM 3303	Soil fertility management			
			BD UC	IP 3314	Industrial practice	5	6	Pass
Innovation and eco-efficiency in agriculture	Module learning outcomes include mastering innovative technologies in agriculture, as well as processing and utilization of waste in the agro-industrial complex. Students study modern technologies and means of mechanization of agricultural production, with a focus on their environmental safety and efficiency of use in agriculture.	15	BD UC	RUWAIC 2205	Recycling and utilization of waste in the agro-industrial complex	4	3	Exam
				OMECP 2206	Operation of machinery and equipment in crop production	5	3	Exam
				ESTA 3211	Environmentally sound technologies in agriculture	5	6	Exam
Crop production	The module learning outcomes include mastering the basics of crop production, as well as learning about plant protection and quarantine methods. Learners also acquire knowledge of crop breeding and seed production, which enables them to effectively manage the process of growing and improving plants.	20	BD UC	CP 3213	Crop production	5	5	Exam
			PD UC	PPQ 3302	Plant protection and quarantine	5	6	Exam
			PD UC	CBSP 4309	Crop breeding and seed production	5	7	Exam
			PD UC	IP 3218	Industrial practice	5	6	Pass
Agro-ecological assessment and monitoring	The module learning outcomes include mastering agroecological monitoring techniques as well as the application of mathematical modeling in agroecology. Learners also learn	40	PD UC	AM 3305	Agroecological monitoring	5	6	Exam
				AM 3213	Agroecology of microorganisms	5	5	Exam
				ECGIS 2209	Environmental cartography	5	4	Exam



	the processes of agroecological land assessment, which enables them to analyze and manage the environmental aspects of agricultural activities.				and GIS			
				MMA 4306	Mathematical modeling in agroecology	3	7	Exam
				AAL 4312	Agroecological assessment of lands	5	7	Exam
				TSER 4308	Technogenic systems and environmental risks	4	7	Exam
				IP 4313	Industrial practice	22	8	Pass
				PDP 4314	Pre-degree practice			Pass
Agro-industrial management and regulatory frameworks	Learning outcomes of the module include mastering the skills of logistics of production processes in agriculture, technical regulation in agroecology, basics of economics and organization of agricultural production, as well as project management in agro-industrial complex.	13	PD UC	LPPA 4310	Logistics of production processes in agriculture	3	7	Exam
			PD UC	RLSDFAIC 2301	Regulatory and legal support and document flow in the agro-industrial complex	5	4	Exam
			PD UC	TRA 4304	Technical regulation in agroecology	5	7	Exam
				EOAP 4304	Economics and organization of agricultural production			
			PD UC	PM 4311	Project Management	5	7	Exam
Minor 1 Language	The module learning outcomes cover improving language proficiency for everyday communication, improving communicative skills in a variety of	20	BD UC	EDU 2216	English for everyday use	5	3	Exam
				ECS 2216	English in communicative situations	5	4	Exam
				ESPC 3216	English in situations of professional	5	5	Exam



	situations, developing professional language communication and specialized use of English for specific purposes.				communication			
				ESP 3307	English for a specific purpose	5	6	Exam
Minor 2 Information technologies in the professional sphere	The learning outcomes of the module consist of students acquiring the knowledge and skills to effectively use IT tools in their professional activities.	20		DV 2216	Data visualization	5	3	Exam
				ASO 2216	Automation of settlement operations	5	4	Exam
				DABP 3216	Data analysis and business planning	5	5	Exam
				EB 3307	E-business	5	6	Exam
Final attestation		8	FA	WDDWPP CE 4401	Writing and defense of the diploma work (project) / Preparation and passing the comprehensive examination	8	8	Defense of the diploma work (thesis)
Toral						243		

In the content of EP Agroecology developed at KEnEU, it is planned to master 243 credits.

General compulsory modules of KazNARU are educational components of general education disciplines that form general competences of higher education. These modules include disciplines of the DGS cycle of the standard curriculum of the speciality and form systemic, general cultural competences of students of the educational programme 6B08107-"Agroecology" Table 12.

Table 12 - General compulsory modules of the educational programme 6B08107-"Agroecology"

Module (ECTS)	Forming competences	Disciplines included in the
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		module
Module 1: Humanitarian and linguistic	- demonstrate knowledge and understanding of the main stages of development of the history of Kazakhstan; - correlate phenomena and events of the historical past with the general paradigm of the world-historical development of human society through critical analysis; - possess the skills of analytical and axiological analysis in the study of historical processes and phenomena of modern Kazakhstan; - be able to objectively and comprehensively comprehend the intrinsic features of the modern Kazakhstani model of development; - systematize and give a critical assessment of the historical and socio-historical development of Kazakhstan; - systematize and give a critical assessment of the historical and socio-historical development of Kazakhstan.	History of Kazakhstan, Philosophy Foreign language Kazakh (Russian) language
Module 2. Professional and communicative	- Evaluate the actions and deeds of communication participants. - to use in personal activities various types of information and communication technologies: Internet resources, cloud and mobile services for searching, storing, processing, protecting and disseminating information;- to collect facts, their constant updating and systematisation, critical analysis and, on this basis, synthesis of new knowledge;- to analyse events and actions from the point of view of the field of legal regulation and be able to refer to the necessary normative acts;- to navigate in the current legislation;- to use the law to protect their rights and inter - understand the role and importance of law in the life of modern society; - be able to navigate in the current legislation - be able to use the norms of the law, protect their rights and legitimate interests; - know the content of basic terms in the field of ecology, rational use of natural resources; modern global and regional environmental problems and ways to solve them; - be able to apply ecological knowledge to solve and forecast possible environmental problems; - apply methods of low-waste production and assessment of environmental efficiency - use in personal activities various types of information and communication technologies: Internet resources, cloud and mobile services for searching, storing, processing, protecting and	Law and anti-corruption culture Ecology Life safety Fundamentals of scientific research Information and communication technologies



	disseminating information; - gathering facts, their constant updating and systematisation, critical analysis and, on this basis, synthesis of new knowledge	
Module 3: Social and Political Knowledge and Healthy Lifestyle	<ul style="list-style-type: none"> - evaluate situations in various spheres of interpersonal, social and professional communication, taking into account the basic knowledge of sociology, political science, culturology and psychology; - synthesise knowledge of these sciences as a modern product of integrative processes; - use scientific methods and techniques of research of a particular science, as well as the entire socio-political cluster; - develop their own moral and civic position; - Operate public, business, cultural, legal and ethical norms of Kazakhstani society 	Module of socio-political knowledge (sociology, political science, cultural studies, psychology) Physical education
Module 4: Science training	<ul style="list-style-type: none"> - apply theoretical knowledge to solve specific physical problems and situations, analyze the results of physical experiment, model physical situations using information technology methods; - formulate techniques for solving mathematical problems and theoretical conclusions with bringing the solution to a practically acceptable result; - argue interest in the study of biology, mastery of techniques and methods of planning and setting up an experiment, analysis and synthesis of biological processes; - describe the theoretical basis of the 	Higher mathematics Plant biology Inorganic and organic chemistry Physics (with the basics of biophysics) Ecological chemistry Biogeochemistry and ecotoxicology
Module 5. Soil-climatic factors for crop cultivation	<ul style="list-style-type: none"> - compare observation of meteorological elements; obtained observations and measurements the impact of crops on changes in agrometeorological conditions; crops in different agroclimatic zones; - characterize the features of soil type, its place in the soil cover of the Earth; general theoretical issues of soil science, features of structure, composition, factors and main processes of soil formation; - distinguish the properties of microorganisms and environmental factors on the life activity of microorganisms, the role of microorganisms in the transformation of substances in nature; 	Agrometeorology Soil science Agroecology of microorganisms
Module 6. Fundamentals of	<ul style="list-style-type: none"> - use the culture of thinking, the ability to generalize, analyze, perceive information, set a 	Agrarian economics Fundamentals of financial



<p>agribusiness and entrepreneurship</p>	<p>goal and choose ways to achieve it;</p> <ul style="list-style-type: none"> - criticize knowledge about the essence and forms of manifestation of economic phenomena and processes of analysis and assessment of the state and trends in socio-economic development of the national and world economy, interdisciplinary approach in solving economic problems; - compare world historical processes, processes and phenomena occurring in society (including economics); - know the fundamental problems of the functioning of economics, the mechanism of action and manifestation of economic laws, as well as the main features of the leading schools and directions of economic science; - know the current state and trends in the development of international economics; - know economic terms and categories, to use them in their academic activities; 	<p>literacy Entrepreneurship Economics</p>
<p>Module 7. Farming systems and technical support</p>	<ul style="list-style-type: none"> - apply the acquired knowledge to solve the issues of safety and reliability of operation of machines and equipment; - change the complex and nature of anthropogenic impact on soils, ways of their rational use, adjustment of main mechanisms and systems of tractors and agricultural machines; - describe theoretical and practical issues of farming; - characterize scientifically-based crop rotations by specialization and biological features of agricultural crops; - compare different methods of soil cultivation and technological methods in cultivation of crops, the system of soil cultivation for different crops. - characterize the structure and functions of vegetative organs of plants on the basis of biological and morphological features of agricultural crops, - make a plan for laying production and experimental experiments, natural and artificial reproduction of crops, cultivation technology. 	<p>Operation of machinery and equipment in crop production Crop production Technical regulation in agroecology</p>
<p>Module 8. Production technologies and crop protection</p>	<ul style="list-style-type: none"> - evaluate the ways of plant growing development, production-biological and morphological classification of plants; the role of vegetables in the national diet; - develop a set of preventive and protective 	<p>Basics of horticulture General entomology Crop protection against pests and diseases</p>



	measures against pests and diseases of agricultural crops, select methods and predict the development of diseases, weeds and pests.	
Module 9. Optimization of crop mineral nutrition and soil fertility in modern farming systems	<ul style="list-style-type: none"> - characterize the chemical composition of soils, plants and fertilizers, types of plant nutrition, classification of fertilizers, preparation of plant samples for analysis and selection of an average sample. Tests for the presence of chemical elements in plants, determining the lack of nutritional elements by external signs; - determine and calculate norms, fertilizer doses, fertility levels, fertilizer rates for the planned harvest; - practice field experience with doses, types, forms, ratios and combinations of fertilizers; - evaluate the basics of plant nutrition and ways to regulate them; basic soil properties in connection with plant nutrition and fertilizer use; methods of stationary study of the "life" of the soil; - develop agrochemical monitoring and agrochemical cartograms of nutrient element availability - plan soil and plant sampling for analysis, laying and conducting field, production and laboratory experiments with fertilizers 	<p>Agrochemistry Fertilizer application system Soil fertility management Soil conservation</p>
Module 8. Environment and sustainable development	<ul style="list-style-type: none"> - operate social, business, cultural, legal and ethical norms in ecology and environment; - observe the impact of the natural environment on humans, the main methods used to study the bioclimate; - apply ecological research methods and diagnose environmental problems and assimilate regional features of climate formation. 	<p>Agriculture and Environment Environmental Ethics Protection of Aquatic Ecosystems Environmental Basis for Sustainable Agriculture Principles of Agroecology</p>
Module 9 Monitoring and Environment	<ul style="list-style-type: none"> - possess standard methods of environmental monitoring; - develop measures to prevent depletion and pollution of soil resources, assess the impact of human activity on soil; - organize and conduct field and experimental agroecological research; - conduct agroecological assessment of natural and anthropogenic landscapes; - possess skills in processing data on the agroecological state of soils and soil biota 	<p>Biogeocenology Agroecological monitoring Basics of bioindication of environmental pollution Technical regulation in agroecology</p>
Module 10 Natural Resources and	<ul style="list-style-type: none"> - solve the problems of disturbed ecosystems, nature protection and rational nature management; 	<p>Environmental protection and rational use of natural resources</p>



Sustainable Management	<ul style="list-style-type: none"> - distinguish between natural and artificial sources of radiation and their consequences. - identify and define soil processes and possible ways of their regulation; to diagnose the main signs of erosion spreading, while collecting reliable statistical information; - have in-depth knowledge of restoration of polluted and disturbed lands, to be able to use this knowledge correctly in production and scientific sphere. 	<p>Agroecological assessment of soils Ecological modeling of agroecosystems Fundamentals of environmental regulation in agroecology</p>
Module 11 Digitalization of Agriculture and Environment	<ul style="list-style-type: none"> - choose working routes, placement of soil transects on the ground and allocation of soil contours; - classify morphological description of soils by basic taxonomic units, soil types, subtypes, genera, etc. their composition and properties and features of nomenclature and diagnostic indicators; - use on-farm land management projects plan of geographical mapping of soils, laws of geographical distribution of soils, soil cartographic materials; - make soil maps and agrochemical cartograms 	<p>Digital soil mapping Digitalization in agriculture</p>

6 Distinctive features of EP and conditions for organizing dual education

The content of the educational program is developed on the basis of the results of the project "AGROKAZ" and recommendations of employers on the formation of professional competencies and modular system, allowing students to obtain knowledge, skills and abilities for professional activity in the field of agroecology. Obtaining environmental knowledge, skills and abilities along with professional competencies is the uniqueness of this educational program, providing the graduate with the opportunity to apply them in his professional activity in the conditions of modern environmental challenges and has a number of features:

- приобретение профессиональных знаний и опыта в области агрэкологии;
- acquiring practical skills in sustainable agriculture for small and medium-sized businesses in the region;
- providing an opportunity to study and implement elements of sustainable development and environmental technologies in future professional activities;
- acquisition of skills of application of modern ecological methods and technologies in professional activity;
- dual system education;



– joint educational program with Kazakh National Agrarian Research University, Almaty. In the 5th semester students will be given the opportunity of academic exchange, mobility. The training program is developed and adapted for these purposes.

The uniqueness of the educational program is determined by the learning outcomes formed in accordance with the National Qualifications Framework and Dublin Descriptors. The educational program is focused on the training of a generalist in the field of agroecology of both the region and the country as a whole, through the formation of competencies related to the sectoral focus of the region.

The strategic goal of the project is to develop a dual educational program, which requires special regulatory documents.

The rules of dual training organization are regulated by the internal normative document QMS 8.17.1-22 "Rules of dual training organization", approved by the Member of the Board of Academic Affairs dated 27.10.2022, order No. 3.1-07/709. Rules for the organization of dual training at ToU are developed in accordance with the State Compulsory Standard of Higher Education (Order of the Minister of Education and Science of the Republic of Kazakhstan No. 2 dated 20.07.2022).

At KEnEU for the organization of dual training developed "Regulations on the introduction of elements of dual training", approved by the Academic Council of the University, Minutes No. 6 dated 23.01.2024.

At KazNARU for the organization of dual education developed rules "On the organization of dual education at KazNARU" dated 01 March 2024.

In the implementation of dual education, the university carries out planning and organization of educational activities on the basis of combining theoretical training with practical training at work. In this case, in accordance with paragraph 19 of the State Standard of Higher and Postgraduate Education, it is necessary to master at least 30% of the teaching material of the discipline directly at the production site (technological process, financial and economic processes).

Mandatory components of dual training:

- 1) a bilateral agreement on dual training between an enterprise (organization) and a VET institution;
- 2) individual tripartite agreement on dual training between the learner, enterprise (organization) and VET;
- 3) working curriculum of dual training agreed with the organization (enterprise);
- 4) training, workplaces and (or) training production center in enterprises (organizations) equipped for implementation of industrial training and professional practice, or training and production workshops, training farms, training grounds in educational organizations implementing educational programs



of higher and postgraduate education;

5) mentors of industrial training and professional practice at enterprises (organizations).

Dual training is conducted in accordance with a bilateral agreement on dual training. Selection for dual training is conducted by the enterprise (organization) according to the results of an interview with students who have expressed a desire to be trained in dual training. In this case, students submit an application to the head of the department within the first two months from the beginning of the academic year in free form.

When selecting trainees for dual training, the enterprise (organization) takes into account the academic performance (GPA), which must be at least 2.0.

The organization of the educational process is carried out in accordance with the working curricula and programs developed and approved by the educational institution together with the enterprise (organization).

The educational process includes theoretical training in VET, as well as industrial training and professional practice, carried out under the guidance of a master of industrial training, head of practice in training and production workshops, training farms and training grounds, under the guidance of a mentor, master of industrial training, head of practice - on the basis of enterprises (organizations).

Forms, content and scope of industrial training and professional practice are determined on the basis of the current educational programs for the relevant educational program.

During the period of on-the-job training and professional practice, the trainee is subject to the rules of labor regulations of the enterprise in accordance with the requirements of the Labor Code of the Republic of Kazakhstan dated November 23, 2015 (hereinafter - the Labor Code).

During the period of industrial training and professional practice, the trainee performs certain functional duties, which are counted in the employment history of the trainee, and for this time, in accordance with Article 119 of the Labor Code of the Republic of Kazakhstan dated November 23, 2015, in accordance with the decision of the enterprise (organization) may make compensation and other payments.

The document confirming the labor activity of the learner is an individual tripartite agreement on dual training.

Persons undergoing on-the-job training and professional practice are subject to occupational health and safety requirements.

Mid-term certification shall be conducted by the educational institution, which forms an examination commission with the involvement of tutors and (or) specialists from the enterprise (organization) participating in dual training. Upon



agreement with the Board Member for AV - Vice-Rector, it is allowed to organize interim certification, in accordance with the academic calendar, on the basis of the enterprise, with the provision of the results of assessment of the achieved learning outcomes in the form of an official letter or minutes of the commission meeting from the enterprise.

The implementation of dual educational program allows to bring practical and laboratory classes to the employer's base, which allows to master professional competencies directly in the production field conditions.

All **types of practice** are included in modules and form methodical, organizational and managerial competencies, readiness to change social and professional roles.

Final attestation is a separate module (8 ECTS), which forms research competencies and competencies of independent work, it includes a diploma work, pre-diploma practice, state exam on specialty. The enterprise (organization) participates in the intermediate and final attestation of students.

7 Qualification characteristics of the graduate of EP 6B08147 Agroecology

Qualification characteristics of a graduate on EP 6B08 Agroecology in all partner universities in general reflect the essence and are similar to each other.

Qualification characteristics of ToU are summarized as follows:

The area of professional activity of graduates who have mastered the Bachelor's degree program includes:

- soil, agrochemical, agroecological research and development aimed at the rational use and conservation of agrolandscapes in agricultural production;
- control over the state of the environment and compliance with environmental regulations for production and land use;
- agro-ecological assessment of agricultural lands and substantiation of methods of their rational use;
- development of environmentally safe technologies of crop production and soil fertility reproduction; agro-ecological models, soil-ecological standardization.



Objects of professional activity of the graduate:

agrolandscapes and agroecosystems, soils, soil regimes and processes of their functioning, agricultural lands, agricultural crops, fertilizers and ameliorants, technologies of agricultural production and reproduction of soil fertility, agroecological models.

Types of professional activities of a graduate

the main type of professional activity - production and technological;

additional types of professional activities - organizational and managerial, research.

Objectives of the graduate's professional activity:

production and technological activities:

- conducting soil, agrochemical and agroecological surveys of lands; organizing and conducting analyses of soil and plant samples;
- compilation of soil, agroecological and agrochemical maps and cartograms;
- agroecological assessment of plants, soils, fertilizers, plant protection products and ameliorants;
- grouping of lands according to their suitability for agricultural crops and optimization of erosion control organization of the land use territory of an agricultural organization;
- development of fertilizer systems and technological projects for soil fertility reproduction, taking into account the environmental safety of the agrolandscape and measures to protect soils from erosion and deflation;
- chemical, water reclamation and agroforestry land reclamation;
- implementation of environmentally safe technologies for cultivation of agricultural crops and control over the quality of products;
- conducting plant and soil diagnostics, taking measures for agro-ecological optimization of mineral nutrition of plants;
- conducting environmental expertise of agricultural land use objects;
- soil-ecological standardization;

organizational and management activities:

- organization of work of teams of production units of organizations, agrochemical service centers (participation in preparation of operational and perspective plans, schedules, instructions, estimates, requests for consumables, instruments, equipment), preparation of reports according to approved forms and methods;
- organization of performers' work in field and laboratory conditions;



- conducting marketing research in the market of agrochemicals and agricultural products;
- making managerial decisions in crop production under different economic and weather conditions;

research activities:

- analysis of materials of soil, agrochemical and ecological condition of agrolandscapes;
- substantiation of ways to preserve and increase soil fertility and erosion resistance of lands;
- participation in soil, agrochemical and agroecological research;
- generalization and statistical processing of the results of experiments, formulation of conclusions;
- development of methods and techniques of soil fertility reproduction.

The distinctive features of the qualification characteristics of KEnEU graduates can be seen in Table 6.

Table 6 - Qualification characteristics

Field of professional activity
Branches of agricultural production: research institutes of agriculture, firms of various forms of ownership, as well as a bachelor can work directly in the areas of agricultural production, taking into account the environmental impact assessment and compliance with all agro-ecological norms required in the field of agriculture in the cultivation and processing of crops, or can continue their studies in the master's program, etc.
Objects of professional activity
Departments of agriculture of the republic, regions and districts, joint-stock companies, production cooperatives, limited liability partnerships, farms, collective farms, agricultural firms and other agricultural formations.
Subjects of professional activity
Crops, fertilizers, seeds, land resources, machinery, soil, agricultural plant varieties.
Types of professional activities
Assistance in farm management, including crop cultivation, fertilization, harvesting, disease prevention, crop rotation development and marketing of products; organizational and management activities related to the organization of production processes in agroecology, as well as management of these processes; production and technological activities related to the cultivation of crops using intensive or resource-saving technology and the organization of labor in crop farming

Qualification characteristics of KazNARU:

The spheres of professional activity of bachelors are: production, management, research and educational sphere, assessment of ecological situation of the environment, quality control of natural environment and human health, development of measures to prevent, reduce and eliminate the degradation of agricultural production objects (soil,



water, air, plant) and implementation in practice of measures to restore the ecological balance in the agricultural sector.

Objects of professional activity: soil, water, air, plants, animals and produced agricultural products, agro-industrial complexes, educational institutions, research institutes and centers.

Organizational and technological:

- organizing the work of crop production teams in accordance with the technological maps of crop cultivation;
- planning, organization and implementation of the system of agrotechnical measures for reproduction of soil fertility and its protection from erosion, creation of optimal phytosanitary condition of fields;
- conducting experimental work on the application of new technologies and varieties;
- analyze the main ingredients of biopreparations;
- organization of agrochemical service and soil survey works on the scale of a district, region, republic;
- testing and introduction into agricultural production of innovative technologies of fertilizer application in the context of individual farms, taking into account the level of effective and potential soil fertility, as well as biological characteristics of crops, properties of fertilizers and other factors.

Experimental and research:

- conducting visual observations and surveys of crop growth and development;
- accounting and control over agro-ecological safety of agricultural products when using herbicides, fungicides and insecticides;
- accounting and analyses, their sequences, timing and duration;
- research of biotechnological processes in crop production;
- staging and conducting field, vegetation experiments and production tests in different soil and climatic zones of the Republic of Kazakhstan to assess the effect of different technologies of fertilizers, ameliorants and biopreparations;
- compilation of soil maps and agrochemical cartograms, development of methods of restoration and expanded reproduction of soil fertility and methods of fertility management; mastering of modern express methods of analysis of soils, plants, fertilizers, biopreparation, water, air and methods of compilation of soil maps and agrochemical cartograms.

Field and object of professional activity

Scientific and production centers of the Ministry of Agriculture of the Republic of Kazakhstan, Committees on Environment Protection and Natural Resources, republican, regional and district centers of agrochemical service, phytosanitary diagnostics and forecasts and phytosanitary; farms and peasant farms, private production cooperatives, joint stock companies, limited liability partnerships, agro-industrial complexes, educational organizations, specialized research institutes and centers, etc.

Functions of professional activity



- study of scientific and technical information and special literature, achievements of domestic and foreign agrarian science;
- collection, processing, analysis and systematisation of scientific and technical information in the areas of specialties;
- agroecological monitoring of economic entities, plants, soils, air and water;
- drawing up soil maps and agrochemical cartograms;
- agro-production grouping and agro-ecological assessment of agricultural lands;
- development of measures to preserve and reproduce soil fertility;
- agroecological and economic evaluation of the efficiency of fertiliser and ameliorant application in economic entities;
- participation in the implementation of research and development results.
- promote the introduction of research and development results into production;
- attracting employers, finding partners for the fulfilment of scientific research.

Types of professional activities

1. Evaluative:

on the basis of a clear representation of the main content of the agroecologist's function as the organization and implementation of modern agrotechnical methods of crop cultivation in production: - уметь рационально и эффективно использовать земельные, водные, лесные, трудовые, материальные и другие ресурсы;

- have skills to organise and develop nature protection, ecologically safe system of farming, to conduct experiments of plant production for the presence of dangerous harmful substances;
- be able to organise biotechnological processes in crop production.

2. Constructive:

- agro-landscapes and agro-ecosystems;
- soils, regimes and processes of their functioning;
- agricultural lands and agricultural crops;
- fertilizers and chemical ameliorants, means and technologies of soil protection;
- technology of crop production and reproduction of soil fertility;

3. Information and Technology:

Use agroecological, geoinformation systems in the development of technologies to optimise soil fertility and crop production.

- justify the optimal way of using soil resources, means of chemicalisation and mechanisation of high economic and agro-ecological technology;
- know modern problems of farming, soil science, agrochemistry, plant protection and ecology, technologies of soil fertility reproduction, scientific and technological policy in the field of environmentally safe crop production.

Have skills:

- use land, water, forest, material and other labour resources rationally and efficiently; draw up modern short-rotation crop rotation schemes for farms and other farms, taking into account their land resources and plans for their development and implementation;



- draw up technological maps for cultivation of agricultural crops and organise field work in accordance with them;

-set the rate of sowing of agricultural seeds, fertilizers, pesticides, etc. and calculate the need of the farm in seeds, fertilizers, pesticides, agricultural machinery, tools and equipment, labour resources;

-ability to independently manage and control the process of labour and learning activities, discuss problems, argue, draw conclusions and competently operate information.

- competence in issues of environmental safety and sustainable development in the field of application of methods of realisation of low-waste productions and assessment of ecological and technogenic situations in agricultural activity;

- assess the ecological and economic consequences of anthropogenic activities, as well as in the issues in the provision of environmental products and the use of new environmental protection and resource-saving technologies.

8 Structure and content of the program

1) The educational program consists of 8 semesters, each of which includes 30 credits. The total duration of the study program is four years, and the number of credits at ToU - 240 ECTS; KEnEU - 243 ECTS; KazNARU - 244 ECTS.

2) Admission shall be on an annual basis.

3) The educational program is designed in accordance with the curriculum.

The educational program is modular.

1) ECTS credit points are assigned to individual modules according to the European Credit Transfer and Accumulation System (ECTS).

2) Each module is designed for five ECTS credit points, with the exception of the module on thesis writing (8 ECTS).

3) One ECTS corresponds to 25-30 hours of student workload. The load includes attendance at lectures and seminars, independent study and other independent coursework, preparation for examinations, examinations, written papers and other study-related assignments and activities throughout the semester.

4) Five ECTS credits correspond to a full-time student workload that will enable the student to successfully complete one module; with the exception of the dissertation writing module (15 ECTS).

5) Faculty should consider this workload when designing and implementing modules.

For each practical phase, an enterprise mentor is identified, who acts as a contact person for the student and provides technical and organizational support to the student to complete his/her tasks for the credit of the practical modules as well as



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his/her daily work. The enterprise mentor and the academic supervisor from the HEI jointly assess the student's achievement of learning outcomes during the practical modules on the basis of a report, paper or practical assignment prepared and/or submitted by the student. The final assessment is left to the HEI.

The degree diploma reflects marks for all modules completed; this includes recognized academic achievements. The topic and assessment of the final thesis. The final grade is calculated on the basis of the module grades as a weighted average, according to the volume of credits, ECTS per module.



Conclusion

Implementation of work package activities completed on time and executed fully according to the project plan.

The development of educational programs in the field of agroecology was predetermined by intensive socio-economic changes, new priorities in the development of the education system and the country as a whole; fundamental changes in the system of higher and postgraduate education of the RK.

Designing and development of educational programs conditioned by new challenges, as well as changed priorities of the State policy, arising from the Message of the President of RK N.A. Nazarbayev to the people of Kazakhstan dated December 14, 2012 "Strategy "Kazakhstan-2050" - a new political course of the established state", the Decree of the President of RK dated March 1, 2016 No. 205 "On approval of the State program of development of education and science of RK for 2016 - 2019 years"; the Decree of the President of RK from August 1, 2014 No. 874 "On approval of the State program of industrial development of RK for 2016 - 2019 years"; the Decree of the President of RK dated August 1, 2014 No. 874 "On approval of the State program of education and science of RK for 2016 - 2019 years" and on making additions to the Decree of the President of the Republic of Kazakhstan dated March 19, 2010 No. 957 "On Approval of the List of State Programs"; the Decree of the President of the Republic of Kazakhstan dated February 1, 2010 No. 922 "On the Strategic Development Plan of the Republic of Kazakhstan until 2020", the State Compulsory Standard of Higher Education, approved by the Government of the Republic of Kazakhstan on October 31, 2018 No. 604 (as amended by the Government of the Republic of Kazakhstan on May 05, 2020 No. 182).

Educational program 6B08147 Agroecology is developed, coordinated and approved in all partner universities, included in the register of educational programs of the Ministry of Education and Science of the Republic of Kazakhstan, has been successfully examined. It is ready for implementation in accordance with the normative legal acts in the field of education of the Ministry of Education and Science of the Republic of Kazakhstan.



Regulatory and legal support

- 1 Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III "On Education".
- 2 "On Approval of the Classifier of directions of training of personnel with higher and postgraduate education". Order of the Minister of Education and Science of the Republic of Kazakhstan dated June 5, 2020 No. 234.
- 3 "On Approval of State Compulsory Standards of Higher and Postgraduate Education". Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No 2.
- 4 "On Approval of the Rules of organization of educational process on credit technology of education in organizations of higher and (or) postgraduate education". Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152.
- 5 Guidelines for the development of educational programs of higher and postgraduate education. Annex 1 to the order of the Director of the National Center for Higher Education Development of MES RK Dated 04.05.2023 No. 601 n/k.
- 6 Professional standards and sectoral qualification frameworks posted on the website of the National Chamber of Entrepreneurs "Atameken": Professional standard "Gardening activities" - Annex No. 1 to the order of the Acting Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 26.10.2022 No. 190 https://atameken.kz/uploads/content/files/22_%20%D0%9F%D0%A1%20%D0%A1%D0%B0%D0%B4%D0%BE%D0%B2%D0%BE%D0%B4_%20%D0%B4%D0%B5%D1%8F%D1%82%D0%B5%D0%B%D1%8C.docx
- 7 Professional standard "Growing legumes and oilseeds" Appendix #4 to the order of the Acting Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken", (link <https://atameken.kz/ru/services/16>).
- 8 Professional standard: "Growing vegetables and potatoes" (Annex No. 18 to the order of the Acting Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 26.10.2022 No.190), (link <https://atameken.kz/ru/services/16>).
- 9 Professional standard: "Growing legumes and oilseeds" (Annex No. 4 to the order of the Acting Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 26.10.2022 No.190), (link <https://atameken.kz/ru/services/16>).



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- 10 Professional standard: "Hydrometeorology and ecology" (Annex No. 79 to the order of the Acting Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 01.09.2023 No. 136 (link <https://atameken.kz/ru/services/16>).
 - 11 Atlas of new professions and competencies in the Republic of Kazakhstan. Ecotechnologist (link: <https://www.enbek.kz/atlas/profession/209>).
 - 12 Atlas of new professions and competencies in the Republic of Kazakhstan. Ecosystem Management Technologist (link: <https://www.enbek.kz/atlas/profession/212>).