Final Report

New and Innovative Courses for Precision Agriculture

NICOPA

TURKMEN AGRICULTURAL INSTITUTE

Mr. Babageldi Kurbanov - Head of the Department of Agricultural land reclamation

Joint Project: Capacity Building in the Field of Higher Education ERASMUS+ 2018

Co-funded by the Erasmus+ Programme of the European Union

CURRICULA (5 year system)

Table 2.1.1. UPDATED COURSES

Course №	Title of the course and in which program it is taught (Bachelor, Master)	Its volume (in ECTS)	Number of students participating in the course	Name new elements in the course and estimate the percentage they represent in relation to the preexisting course	Link to the course on the university page	Accreditation and recognition*: Specify the date when the course was accredited/certified in the curriculum and when the pilot teaching started. Include a scan of the accreditation certificate to the presentation
5 year system						
Course 1	Geodesy	204	24	20%, Introduced the chapter "Geodesy and navigation systems", "Possibilities for the development of geodesy"	Teachers teaching this course post their teaching aids in the library of the institute	Letter from the Ministry of Education of Turkmenistan dated July 2, 2022
Course 2	Agrometeorology	90	117	15%, Introduced the chapters "Remote sensing of soil moisture, salinity, vegetation cover"	Teachers teaching this course post their teaching aids in the library of the institute	Letter from the Ministry of Education of Turkmenistan dated June 12, 2021

CURRICULA (5 year system)

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5 year system						
Course 3	Climatology	64	40	15%, Introduced chapter "Climate monitoring via satellites"	Teachers teaching this course post their teaching aids in the library of the institute	Letter from the Ministry of Education of Turkmenistan dated August 29, 2022
Course 4	Hydrology	90	40	20%, Introduced the chapter "Remote monitoring of hydrological and hydrometric observations"	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated November 10, June 2022

CURRICULA (5 year system)

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5 year system						
Course 5	Hydrology and hydrometry	134	40	20%, Introduced the chapter "Remote monitoring of hydrological and hydrometric observations"	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated June 12, 2021
Course 6	Hydrology and flow regulation	90	40	20%, Introduced the chapter "Remote monitoring of hydrological and hydrometric observations"	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated June 12, 2021

CURRICULA (5 year system)

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5 year system						
Course 7	Mechanization of technological work in animal husbandry	136	48	20%, Introduced the chapters "Precision livestock", "Smart farm", "Telematic transport management"	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated November 9, 2021
Course 8	Fruit growing and viticulture	120	60	15%, Introduced the chapter "Opportunities and prospects for the use of precision agricultural technologies in the cultivation of fruits and grapes"	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated November 10, June 2022

CURRICULA (5 year system)

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5 year system						
Course 9	Organization and management of agricultural production	84	80	20%, Introduced the chapters “Organizing precision farming” and “Organizing precision livestock”	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated June 12, 2021
Course 10	Soil science	152	117	20%, Topics introduced "Modern methods of remote sensing of soil density in precision agriculture", "Modern methods of remote sensing of physical and mechanical properties of soil in precision agriculture", "Modern methods for determining the amount of water in soil in precision agriculture", "Modern methods of remote sensing of the level of groundwater in precision agriculture", "Modern methods of remote sensing soil nutrients in precision agriculture"	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated June 12, 2021

CURRICULA (5 year system)

Table 2.1.1. UPDATED COURSES

Course №	Title of the course and in which program it is taught (Bachelor, Master)	Its volume (in ECTS)	Number of students participating in the course	Name new elements in the course and estimate the percentage they represent in relation to the preexisting course	Link to the course on the university page	Accreditation and recognition*: Specify the date when the course was accredited/certified in the curriculum and when the pilot teaching started. Include a scan of the accreditation certificate to the presentation
5 year system						
Course 11	Operation of the machine and tractor fleet	120	128	20%, Introduced the chapters "Automation of machine and tractor fleet management", "Differentiated technologies of precision agriculture", "Sensors for determining the state of plants", "Yield mapping systems"	Teachers teaching this course post their teaching aids in the library of the institute.	The curriculum was discussed and approved by the Educational and Methodological Working Group of the Faculty of Hydromelioration and Agricultural Mechanization at a meeting on July 21, 2020 (Protocol No. 11).
Course 12	Agricultural economics	64	282	20%, Introduced the chapters "Economic efficiency of precision farming in the agro-industrial complex", "Use of labor resources in precision farming", "Economics of precision farming", "Economics of production of vegetables and potatoes in precision farming"	Teachers teaching this course post their teaching aids in the library of the institute.	The curriculum was discussed and approved by the Educational and Methodical Working Group of the Faculty of Veterinary Medicine at the meeting of 18 July 2020 (Protocol No. 15).

CURRICULA (Bachelor)

Table 2.1.1. UPDATED COURSES

Course №	Title of the course and in which program it is taught (Bachelor, Master)	Its volume (in ECTS)	Number of students participating in the course	Name new elements in the course and estimate the percentage they represent in relation to the preexisting course	Link to the course on the university page	Accreditation and recognition*: Specify the date when the course was accredited/certified in the curriculum and when the pilot teaching started. Include a scan of the accreditation certificate to the presentation
Bachelor						
Course 13	Economics of agriculture (training is conducted in English)	4	20	20%, Introduced the chapters "Economic efficiency of precision farming in the agro-industrial complex", "Use of labor resources in precision farming", "Economics of precision farming", "Economics of production of vegetables and potatoes in precision farming"	Teachers teaching this course post their teaching aids in the library of the institute.	The curriculum was discussed and approved by the Educational and Methodical Working Group of the Faculty of Veterinary Medicine at the meeting of 18 July 2020 (Protocol No. 15).
Course 14	Economics of agriculture	4	20	20%, Introduced the chapters "Economic efficiency of precision farming in the agro-industrial complex", "Use of labor resources in precision farming", "Economics of precision farming", "Economics of production of vegetables and potatoes in precision farming"	Teachers teaching this course post their teaching aids in the library of the institute.	The curriculum was discussed and approved by the Educational and Methodical Working Group of the Faculty of Veterinary Medicine at the meeting of 18 July 2020 (Protocol No. 15).

∑(Total number of updated courses) = 14

∑(Total number of ECTS) = 8

CURRICULA (5 year system)

Table 2.2.2.NEW COURSES

Course №	Title of the course and in which program it is taught (Bachelor, Master, 5 years system for TM)	Its volume (in ECTS hours for TM in case no ECTS)	Number of students participating in the course	Link to the course on the university page	Accreditation and recognition: Specify the date when the course was accredited in the curriculum and when the pilot teaching started
Course 1	Geographic information system	70	193	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated July 2, 2022
Course 2	Photogrammetry and remote sensing	112	24	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated June 12, 2021
Course 3	Precision Agriculture	70	64	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated November 10, June 2022
Course 4	Modern geodetic instruments	60	24	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated July 2, 2022

CURRICULA (Bachelor)

Table 2.2.2.NEW COURSES

Course №	Title of the course and in which program it is taught (Bachelor, Master, 5 years system for TM)	Its volume (in ECTS hours for TM in case no ECTS)	Number of students participating in the course	Link to the course on the university page	Accreditation and recognition: Specify the date when the course was accredited in the curriculum and when the pilot teaching started
Course 5	Geoinformation Systems (training is conducted in English)	3	20	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated July 2, 2022
Course 6	Precision Agriculture (training is conducted in English)	3	20	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated July 2, 2022
Course 7	Precision Agriculture	3	20	Teachers teaching this course post their teaching aids in the library of the institute.	Letter from the Ministry of Education of Turkmenistan dated November 10, June 2022

∑(Total number of new courses) = 7

∑(Total number of ECTS) = 9

CURRICULA DESCRIPTION

Link:
https://drive.google.com/drive/folders/13v_j6smjzw1va6R7aZbOMgMrI42bh2Sv

TEACHING MATERIALS

№	Title of the materials	Type (manuals/text books/methodological recommendations)	Short description	Location of the teaching material (place/ link in the internet)
1.	Agrometeorology	Methodological recommendations	Information about a modern automatic weather station for determining agrometeorological data is included in the methodological manual. The following information about the device and structure of automatic weather stations, technical characteristics of the sensors used in them.	-
2.	Geographic information system	Methodological recommendations	By completing the Geographic Information Systems course, students will learn an understanding of spatial data, satellite systems, geographic information systems software, vector and raster models, and will also be able to use course methods to solve practical problems.	-
3.	Modern geodetic instruments	Methodological recommendations	-	-

TEACHING MATERIALS

№	Title of the materials	Type (manuals/text books/methodological recommendations)	Short description	Location of the teaching material (place/ link in the internet)
4.	Precision Agriculture	Text book	The textbook examines the scientific foundations of precision agriculture, its goals and objectives, the use of digital, information and space technologies in agriculture, parallel drive systems for agricultural machines, technology for mapping crop fields, and technology for monitoring the condition of crops. The importance and technology of carrying out agrotechnical activities are described in a differentiated manner, namely information about livestock technologies, environmental and economic aspects of precision farming, and world experience in precision farming.	-

PILOT TEACHING

Please report on the pilot teaching of updated/new curricula/modules/courses:

#	Title of the course	Number of students participating in the course
1.	Geodesy	24
2.	Agrometeorology	117
3.	Climatology	40
4.	Hydrology	40
5.	Hydrology and hydrometry	40
6.	Hydrology and flow regulation	40
7.	Soil science	117
8.	Geographic information system	193
9.	Photogrammetry and remote sensing	24
TOTAL		**635**

PILOT TEACHING

- Number of the enrolled students – **635**;
- Please, report on the gender balance of the enrolled students – **BOY – 431, GIRL - 204**;
- Did you involve in the pilot teaching any people with fewer opportunities? *

  *a) Disability – **1***

  *b) cultural differences – **2 (students from Afghanistan)***
- Amount of the courses with ECTS, involved in the pilot teaching – **1**;
- Number of teachers involved in the pilot teaching – **5**;

QUALITY ASSURANCE

Report on the new peer review procedures: which new modules were reviewed during the last 12 months?

1. Geodesy – modul “Geodesy and navigation systems”
2. Agrometeorology – modul “Remote sensing of soil moisture, salinity, vegetation cover”
3. Climatology – modul “Climate monitoring via satellites”
4. Geographic information system – modul “Creating a raster terrain model in QGIS”
5. Precision Agriculture – modul “Precision irrigation”

QUALITY ASSURANCE

Who were peer reviewers?

1. Geodesy – M. Allakov, Senior Lecturer at Turkmen State University
2. Agrometeorology – G. Hemrayev, Senior Lecturer at Turkmen State University
3. Climatology – R. Geldiyev, Senior Lecturer at the Turkmen Agricultural University
4. Geographic information system – M. Allakov, Senior Lecturer at Turkmen State University
5. Precision Agriculture – M. Allakov, Senior Lecturer at Turkmen State University; R. Geldiyev, Senior Lecturer at the Turkmen Agricultural University

QUALITY ASSURANCE

When did you conduct peer reviews?

In 2021

Did you collect questionnaires from students, teachers, employers during/after the pilot training? Please, report.

1. from 23 to 29 May, 2019:

a) 1-4 year students were given questionnaire – total 744 students; b) Lectureres – 60.

2. from 25 January 2011:

a) 1-2 year students were given questionnaire – total 53 students; b) Lectureres – 14.

3. from 11 to 16 January 2011:

a) 1-2 year students were given questionnaire – total 57 students; b) Lectureres – 26.

LABORATORIES AND EQUIPMENT

#	Title of the course	Laboratory works	Which equipment is used
1.	Agrometeorology	1. Measurement of solar radiation 2. Measurement of soil temperature 3. Measurement of air temperature 4. Measurement of evapotranspiration 5. Measurement of air humidity 6. Study of the duration and intensity of precipitation 7. Measurement of soil moisture 8. Building a wind rose 9. Automatic weather station	1. Hygroclip 2. Barometer 3. Rain gauge 4. Pyranometer 5. Wind speed 6. Irrometer Watermark
2.	Climatology	1. Measurement of solar radiation 2. Measurement of soil temperature 3. Measurement of air temperature 4. Measurement of evapotranspiration 5. Measurement of air humidity 6. Study of the duration and intensity of precipitation 7. Measurement of soil moisture 8. Building a wind rose 9. Automatic weather station	1. Hygroclip 2. Barometer 3. Rain gauge 4. Pyranometer 5. Wind speed 6. Irrometer Watermark

LABORATORIES AND EQUIPMENT

#	Title of the course	Laboratory works	Which equipment is used
3.	Soil science	1. Measurement of soil moisture 2. Compilation of electronic spectral soil maps	1. Irrometer Watermark
4.	Photogrammetry and remote sensing	1. Creating a vegetation index map 2. Determination of the vegetation index 3. Preparing the NDVI card	1. AIO PC Intel® Core™ i7-10510U Processor 2. Workstation 9th Generation Intel® Core i7-9750H Processor 3. Notebook 10th Generation Core™ i7-1065G7 Processor 4. MFD, Epson EcoTank Expression Premium ET-7750, High quality photo printing in A3 5. MFD, Canon i-SENSYS MF445dw 6. My Cloud Expert Series EX2 Ultra WD (20TB) 7. SMART Board SB480 + Projector

LABORATORIES AND EQUIPMENT

#	Title of the course	Laboratory works	Which equipment is used
5.	Geographic information system	1. Downloading and installing QGIS 2. Exploring the QGIS 3. Creating layouts in QGIS 4. Loading modules into QGIS 5. Obtaining Landsat and Sentinel satellite images 6. Get data from Openstreetmap 7. Working with GPS data in QGIS 8. Linking scanned maps with vector data in QGIS 9. Modeling raster data in QGIS 10. Vector data modeling in QGIS 11. Presentation of data by interpolation method 12. Creating a raster terrain model in QGIS 13. Defining fields, measuring distances in QGIS 14. Construction of a surface profile 15. Creation of a 3D model of the Earth's surface 16. Creating a map in QGIS 17. Entering card attribute information 18. Creating an NDVI map 19. Determination of NDVI values by fields 20. Reservoir research in QGIS	1. AIO PC Intel® Core™ i7-10510U Processor 2. Workstation 9th Generation Intel® Core i7-9750H Processor 3. Notebook 10th Generation Core™ i7-1065G7 Processor 4. MFD, Epson EcoTank Expression Premium ET-7750, High quality photo printing in A3 5. MFD, Canon i-SENSYS MF445dw 6. My Cloud Expert Series EX2 Ultra WD (20TB) 7. SMART Board SB480 + Projector

DISSEMINATION AND SUSTAINABILITY

DISSEMINATION		
	Question	Answer
1.	How many and which of dissemination materials were produced (leaflets, brochures, flyers, publications etc). Please, provide designs (scans) in the presentation.	Leaflets – 200 Brochures – 100 Flyers – 100 Publications - 5

DISSEMINATION AND SUSTAINABILITY

Table 5.1.1 DISSEMINATION		
	Question	Answer
2.	**Provide a link to the Internet sources where publications about the project/dissemination materials were posted**	Link to the project page on the institute website: http://tohi.edu.tm/nicopa.phd
3.	**How many non-consortium organizations (for example, universities/teachers, students, administrative staff of universities) have been informed about the project?**	Teachers – 150 Students – 620 Administrative staff – 18

DISSEMINATION AND SUSTAINABILITY

Table 5.1.2. DISSEMINATION EVENTS

No	Date	Title	Target Audience	Number of participants	Is there a press-release of the event (YES/NO). If YES, provide it.
1.	30.09.2020	Familiarization of the lecturers of the Department of Technology of irrigation and drainage works with the work of the project "New and innovative courses for precision agriculture (NICOPA)" of the ERASMUS + program	Teaching staff of the department	10	Yes
2.	26.10.2020	Familiarization of the lecturers of the Department of Operation and repair of agricultural techniques with the work of the project "New and innovative courses for precision agriculture (NICOPA)" of the ERASMUS + program	Teaching staff of the department	7	Yes

DISSEMINATION AND SUSTAINABILITY

Table 5.1.2. DISSEMINATION EVENTS					
No	Date	Title	Target Audience	Number of participants	Is there a press-release of the event (YES/NO). If YES, provide it.
3.	03.11.2020	Meeting with representatives of the production association "Dashoguzsuvkhodjalyk"	Representatives of the "Dashoguzsuv-khodjalyk" Production Association	27	Yes
4.	14.11.2020	Familiarization of lecturers of the Department of Agro chemistry and Soil Science with the work of the project "New and innovative courses for precision agriculture (NICOPA)" of the ERASMUS + program	Teaching staff of the department	11	Yes

DISSEMINATION AND SUSTAINABILITY

Table 5.1.2. DISSEMINATION EVENTS					
No	Date	Title	Target Audience	Number of participants	Is there a press-release of the event (YES/NO). If YES, provide it.
5.	28.11.2020	Familiarization of lecturers of the Department of Computer Technology with the work of the project "New and innovative courses for precision agriculture (NICOPA)" of the ERASMUS + program	Teaching staff of the department	12	Yes
6.	18.12.2020	Meeting with representatives of the GEF/UNDP/MAEPT project "Support climate resilient livelihoods in agricultural communities in drought-prone areas of Turkmenistan"	Representatives of the GEF/UNDP/MAEPT project "Support climate resilient livelihoods in agricultural communities in drought-prone areas of Turkmenistan"	4	Yes

DISSEMINATION AND SUSTAINABILITY

5.2. Regional Cooperation

- **Within the last 6 months of the project, were any employment events/fairs conducted and how many?**

On November 2, 2020, a scientific and practical conference and exhibition with the participation of teachers and students on the occasion of the Harvest Festival was held at the Institute. A specially prepared stand from the NICOPA project was shown at the exhibition and booklets were distributed.

On December 6, 2020, a conference was held at the Institute and an exhibition of achievements in the field of science and education was held within its framework. A specially prepared stand from the NICOPA project was shown at the exhibition and booklets were distributed.

DISSEMINATION AND SUSTAINABILITY

5.2. Regional Cooperation

- **How many agreements with non-academic stakeholders/other members of the consortium/ other non-consortium members have been signed so far or are planned to be signed in the future to maintain and develop the project results?**

2 agreements were signed with non-academic stakeholders.

DISSEMINATION AND SUSTAINABILITY

5.2. Regional Cooperation

Table 5.2. INDUSTRIAL PARTNERS	
Please, provide a list of new industrial partners, with which you maintain communication within the last 6 project months, and which could be interested in hiring your graduates	List of industrial partners: 1. “Dashoguzsuvhojalyk” Production Association 2. Dashoguz Province Agricultural Production Association 3. Dashoguz Province Grain Production Company 4. Dashoguzpagta Production Association

DISSEMINATION AND SUSTAINABILITY

5.3. Sustainability of PASO Offices

Table 2.4. PASO Service Office		
№	Question	Answer
1.	Name of the person(s) responsible for PASO operation in your university	Babageldi Kurbanov
2.	Provide scan of PASO regulations approved at institutional level	
3.	Provide scan of PASO work plan/business plan approved at institutional level	

DISSEMINATION AND SUSTAINABILITY

5.3. Sustainability of PASO Offices

Table 2.4. PASO Service Office		
№	Question	Answer
4.	Indicate activities, that was already been implemented according to PASO work plan (title of activity, date, link to agenda, number of persons involved)	The PASO work plan cannot be executed due to lack of equipment.
5.	Provide link to the PASO web page at the university website / FB page or any other digital source of PASO	
6.	How many NICOPA+ agreements were signed so far?	2 (two)

NICOPA

Thank you for you attention!

Co-funded by the Erasmus+ Programme of the European Union

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