COURSE PORTFOLIO

PLANT BIOTECHNOLOGY

BACHELOR DEGREE PROGRAM

AGROTECHNOLOGY

FACULTY OF AGRICULTURE

UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR

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Surabaya, Agustus 2021

1. EXPECTED LEARNING OUTCOME (ELO)

ELO-A1	Be defending country character, namely the love of the motherland, national and state awareness, believes in Pancasila as the ideology of the state, willing to sacrifice for the nation and the state, and has the initial ability to defend the country.
ELO-A2	Responsible for work in the field of expertise independently.
ELO-A3	Able to maintain and develop collaborative networks with supervisors, colleagues, colleagues both inside and outside the institution.
ELO-4	Able to apply knowledge of Plant Sciences and basic concepts of Plant Production, Soil and basic concepts of land resources, the concept of crop protection against pests and diseases in an integrated manner.
ELO-5	Able to master the principles of the application of agricultural technology to solve problems in agriculture.
ELO-6	Able to analyze, plan and implement lowland farming systems refers to the principles of sustainable agriculture, modern, raise local wisdom, effectively and productively.
ELO-7	Able to study the implementation of sustainable agriculture systems Base on scientific rules aplication, procedures and ethics in order to produce solutions, ideas, and designs based on the results of information and data analysis.
ELO-8	The ability to master plant propagation technology, and crop management in accordance with the agro-climate zone.
ELO - 9	The ability to identify, formulate, analyze and solve problems in the field of land resources.
ELO - 10	Ability to diagnose, analyze and solve plant pest problems.
ELO - 11	The ability to handle the current principles and issues of lowland agriculture and its environmental problems.
ELO - 12	Mastery of technology and be able to communicate with the community in solving agricultural problems both oral and written.

2. COURSE IDENTITY

1. Name of Course, Code
2. ELO Performance Indicator
3. ELO charged to the Constitutional Course, this data can be obtained from the ELO course matrix
4. Learning Model used
5. Assessment Form

Name of course	PLANT BIOTECHNOLOGY
Code of course	PG 191115
Semester credit unit	3
Learning Model	Tutorial and Discuss Discuss Group Learning Field and Laboratory Practice Problem Base Learning/Project Base Learning Evaluations
Expected Learning Outcomes	ELO 2: Able to internalize academic values, norms, and ethics; spirit of independence, effort and entrepreneurship. ELO 3: Able to maintain and develop collaborative networks with supervisors, colleagues, colleagues both inside and outside the institution. ELO 4: Able to apply knowledge of Plant Science and Basic Concepts of Plant Production, Soil and Basic Concepts of Land Resources, as well as plant pests and diseases and the concept of plant protection against pests and diseases in an integrated manner. ELO 5: Ability to master the principles of applying agricultural technology to solve problems in agriculture.
Performance Indicator	
ELO 2-A	2. Able to apply technopreneurship principles and be able to make a business plan canvas proposal for commercial plant biotechnology products (LLO 7).
ELO 3-A	3. Able to explain and provide arguments about ethics and regulations on biosafety of genetically engineered products (LLO 5).
ELO 4-P	4.1. Able to explain between tissue culture techniques and plant breeding to produce superior agricultural products (LLO 2). 4.2. Able to explain molecular marker analysis techniques in supporting plant breeding programs (LLO 4).
ELO 5-C	5.1. Able to explain and apply in-vitro propagation techniques to produce plant seeds from tissue culture (LLO1). 5.2. Able to explain the devices and techniques of recombinant DNA and the process of gene transformation in genetic engineering (LLO 3). 5.3. Able to design a household-scale tissue culture laboratory for mass propagation (LLO 6).

3. SEMESTER LESSON PLAN

3.1. DETERMINATION OF EXPECTED LEARNING OUTCOMES (ELO) IN COURSES

No.	Sem.	Code of Subject	Name of Subject	Semester Credit System	Percentage (%)			
					ELO 2	ELO 3	ELO 4	ELO 5
	4	PG 191115	Plant Biotechnology	3	X	X	X	X

3.2. SEMESTER LESSON PLAN OF PLANT BIOTECHNOLOGY PRINCIPLES

	UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR AGRICULTURE FACULTY AGROTECHNOLOGY DEPARTMENT BACHELOR DEGREE					
COURSE	**CODE**	**Science Clump**	**Credit Point (CP)**	**SEMESTER**		**Date of Making**
PLANT BIOTECHNOLOGY	**PG 191115**	**Biotechnology**	**3**		**IV**	**23/04/2021**
AUTHORIZATION	**Developer of Semester Lesson Plan**		**Course Coordinator**	**Head of Department**		
	Dr.Ir. MAKHZIAH, MP		**Dr.Ir. SUKENDAH, MSc.**	**Dr.Ir. Bakti Wisnu W, MP**		
Learning Outcomes (LO)	**Expected Learning Outcomes (ELO)**					
	ELO2: Able to internalize academic values, norms, and ethics; spirit of independence, effort and entrepreneurship. ELO3: Able to maintain and develop collaborative networks with supervisors, colleagues, colleagues both inside and outside the institution. ELO4: Able to apply knowledge of Plant Science and basic concepts of Plant Production, Soil and basic concepts of land resources, as well as plant pests and diseases and the concept of plant protection against pests and diseases in an integrated manner. ELO5: Ability to master the principles of applying agricultural technology to solve problems in agriculture.					
	Course Learning Outcome (CLO)					
	1. Able to do all tasks independently with full responsibility, able to work well with a team and able to develop a technopreneurship spirit related to Agricultural Biotechnology courses (ELO 2 and ELO 3). 2. Capable of applying tissue culture technology and mass producing plant seeds and is also able to explain the process of assembling the transgenic plants (ELO 4 and ELO5).					
	LLO					
	Fourth semester student of AGROTEKNOLOGI of UPN VETERAN JAWA TIMUR 1. Able to explain in-vitro propagation techniques and produce plant seeds from tissue culture. 2. Able to explain the relationship between tissue culture techniques (genetic variability) and plant breeding to produce superior agricultural products. 3. Be able to explain the tools and techniques of recombinant DNA and the process of gene transformation in genetic engineering. 4. Able to explain molecular marker analysis techniques in supporting plant breeding programs. 5. Able to explain and provide arguments about ethics and regulations on biosafety of genetically engineered products. 6. Able to apply household-scale tissue culture technology and able to produce plant biotechnology products commercially. 7. Able to apply technopreneurship principles and make a business model canvas for plant biotechnology products.					
Short Description of Course	Principles of Plant Biotechnology provide knowledge and insight into the development of plant biotechnology as well as its techniques and applications in a technopreneurship perspective for crop improvement and the development of commercial plant products. Students are provided with basic concepts of plant biotechnology, the role of biotechnology in agriculture, knowledge and expertise about tissue culture techniques and their applications to produce and commercialize plant tissue culture seeds, recombinant DNA technology and gene transformation, molecular analysis techniques to support the development of superior plant products and ethics and regulation of genetically modified organism.					
Lessons	Basic concepts and developments in industrial biotechnology, in vitro techniques, explant regeneration through organogenesis and somatic embryogenesis, somaclonal variation for agricultural product development, basic principles of genetic engineering in problem solving, recombinant DNA techniques and gene transformation for agricultural products, genetic markers and its applications, ethics and regulation of biosafety of genetically engineered products, management of plant biotechnology laboratories in commercial product development, basic principles of technopreneurship and strategic planning for businesses in plant biotechnology.					

REFERENCES	**Utama:** 1. C. N. Stewart, Jr.. 2008. PLANT BIOTECHNOLOGY AND GENETICS: Principles, Techniques, and Applications. John Wiley & Sons, Inc. 2. A.J. Nair, Ph.D. 2007. Introduction To Biotechnology And Genetic Engineering. Infinity Science Press Llc. 3. PRINCIPLES OF PLANT BIOTECHNOLOGY. ICAR eCourse. 4. PRINCIPLES OF PLANT BIOTECHNOLOGY. TNAU (ICAR) **Pendukung :** 1. Estiati, A. dan M. Herman. 2015. Regulasi Keamanan Hayati Produk Rekayasa Genetik di Indonesia. *Analisis Kebijakan Pertanian*. 13 (2): 129-146 2. Tanaman Genetically Modified Organism (GMO) dan Perspektif Hukumnya di Indonesia. Jurnal Kauniyah
Instructional Media	**Software:** OS Windows, PPT, Video **Hardware:** References Book, LCD, sound system, Office stationery
Team Teaching	1. Dr.Ir. Sukendah, MSc. 2. Dr.Ir. Makhziah, MP 3. Dr. Ir. Pangesti Nugrahani, MSi. 4. Saefurrohman, SP, M.Sc
Requirements course	-

Week	Final ability at each learning stage (Sub-LLO)	Evaluation		Forms of Learning, Learning Methods and Student Assignments [Time estimation]		Subjects [References]	Evaluation (%)
		Evaluation Indicator	Criteria & Assessment Form	Online	Offline		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	LLO 1: Able to explain cell biology systems, the function of DNA genetic material, and the role of plant biotechnology in improving human welfare.	• Accuracy in explaining the biological system of cells, the function of the genetic material DNA. • Accuracy describes the role of plant biotechnology and discovery in improving human welfare.	- Able to make a review of lectures.	PPT, text book, video, jurnal **O=(2x50") SA=(2x60") IS=(2x60")**	- Tutorial and discussion - Make a review of lectures.	- Understanding and the underlying science of plant biotechnology. - The role of plant biotechnology in human life. - The history of the development of plant biotechnology in the perspective of the industrial world.	3%
2,3	LLO 1: Able to explain and apply mass propagation techniques in-vitro.	• Ability to apply tissue culture techniques for plant propagation (mass propagation) • Accuracy explains the meaning of somatic embryogenesis and can distinguish between somatic and zygotic embryogenesis and the process.	- Make questions in essays. - Practice: preparation of the solution and tissue culture media, planting and incubation of explants, subculture and acclimatization.	PPT, text book, video, journal **O=(2x50") SA=(2x60") IS=(2x60")**	- Tutorials - Practises preparation of the solution and tissue culture media, planting and incubation of explants, subculture and acclimatizatio n.	- In-vitro propagation technique - Solution and composition of tissue culture media. - Regeneration of explants through somatic and zygotic embryogenesis. - MS media creation - Micro propagation - Sub culture and acclimatization	17%
4-5	LLO 2: Able to explain tissue culture in mutation induction for formation somaclonal variation and able to relate it to plant breeding program.	- Ability to analyze and review research results related to somaclonal variation. - Accuracy in explaining the relationship of somaclonal variation with plant breeding	- Ability to analyze and review research results related to somaclonal variation. - Accuracy in explaining the relationship of somaclonal variation with plant breeding	PPT, text book, research journal	- Presentation and discussion between groups research journal about somaclonal variation	Somaclonal variation for agricultural product development.	10%

				O=(2x50") SA=(2x60") IS=(2x60")			
6	LLO 3: Able to explain the basic principles of genetic engineering (recombinant DNA) and gene isolation and cloning techniques	1. Accuracy in explaining the principles of genetic engineering & tools needed in genetic engineering. 2. Accuracy in explaining gene isolation and cloning procedures.	- Make questions in essays. .	- PPT, text book, jurnal **O=(2x50") SA=(2x60") IS=(2x60")**	Tutorial and discussion about principles of genetic engineering & tools needed in genetic engineering.	- Recombinant DNA technique - Genetic engineering tools - DNA isolation of target genes and gene cloning	10%
7	LLO: Able to identify problems of cultivated plants and design the process of genetically engineered products (GM).	Ability to draft the transformation process of the target genes into crops through biological methods, physical, and chemical.	Create a research design for genetically engineered plant assembly.	- PPT, text book, jurnal **O=(2x50") SA=(2x60") IS=(2x60")**	- Tutorial - Presentation & discussion	- Biological, physical and chemical gene transformation methods - Research journal	10%
8	**Mid Test**						
9-10	LLO 4: Able to explain genetic markers, DNA marker techniques and their benefits.	1. Accuracy in explaining the meaning, terms and types of genetic markers/DNA markers. 2. The accuracy of explaining the DNA marker technique and the benefits of DNA markers.	- Make questions in the essay. - Presentations and discussions	- PPT, text book, jurnal **O=(2x50") SA=(2x60") IS=(2x60")**	Tutorial Presentation & discussion	- Genetic markers: morphology, cell and molecular - Types and techniques of molecular analysis - Molecular marker applications	10%
11	LLO 5: Able to explain and provide arguments regarding the regulation of genetic engineering product regulation.	1. Accuracy in explaining regulation in regulating GMO products. 2. Ability to provide arguments for Regulation Regulation of transgenic plants.	Discussion on Law no. 21 of 2004 concerning the ratification of the Cartagena protocol, and Government Regulation no. 21 of 2005.	- PPT, text book, jurnal **O=(2x50") SA=(2x60") IS=(2x60")**	Discussion between groups about Discussion on Law no. 21 of 2004 concerning the ratification of the Cartagena protocol, and Government Regulation no. 21 of 2005.	1.2004 concerning the ratification of the Cartagena protocol, and Government Regulation no. 21 of 2005. 2. Journal of Biosafety of Genetically Engineered Products.	10%
12	LLO 6: Able to explain the management of plant biotechnology laboratories in the development of commercial products for household-scale tissue culture laboratories.	1. Accuracy in explaining laboratory management and tissue culture laboratory development. 2. Ability to create a vision, mission and program for the development of a household scale tissue culture laboratory.	Applying and managing household-scale tissue culture laboratories.	- PPT, text book, jurnal **O=(2x50") SA=(2x60") IS=(2x60")**	Practice of designing and managing household-scale tissue culture laboratories.	Plant biotechnology laboratory management in commercial product development.	10%
13	LLO 7: Able to explain the basic principles of technopreneurship in the field of	- Accuracy in explaining the role of technopreneurship and professionalism in	- Membuat soal dalam essay. - Diskusi.	- PPT, text book, jurnal **O= (2x50") SA = (2x60") IS= (2x60")**	- Tutorial and discussion	The basic principles of technopreneurship in the field of plant biotechnology.	5%

	plant biotechnology.	the field of plant biotechnology. - Ability to explain innovative ideas in plant biotechnology production.					
14-15	LLO 7: Able to plan and make business plan proposals about plant biotechnology products.	Ability to make strategic business/business planning in plant biotechnology.	Making a proposal for the Entrepreneurship Student Creativity Program (PKM-K) for a business plan canvas in the production of tissue culture seeds.	- PPT, text book, jurnal **O= (2x50")** **SA = (2x60")** **IS= (2x60")**	- Presentation and discussion about proposal for the Entrepreneurship Student Creativity Program (PKM-K) for a business plan canvas in the production of tissue culture	Proposal for Entrepreneurship Student Creativity Program Network culture for small/home industries.	15%
16	**Final Test** **Evaluation of CLO achievement put upon course**						
Total							

Notes:

1. **Expected Learning Outcomes (ELO)** is the ability of each graduate which is the internalization of attitudes, mastery of knowledge and skills in accordance with the level of study program obtained through the learning process.
2. **ELO** charged to the course are several learning outcomes of study program graduates (ELO) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course Learning Outcomes (LLO)** is an ability that is specifically described from ELO which is charged to the course, and is specific to the study material or learning material of the course.
4. **Lesson Learning Outcomes (LLO)** is the ability that is described specifically from the SLO that can be measured or observed and is the final ability that is planned at each stage of learning, and is specific to the learning material of the course.
5. **Assessment Indicators** is ability in the process and student learning outcomes is a specific and measurable statement that identifies the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** is a benchmark that is used as a measure or benchmark for learning achievement in an assessment based on predetermined indicators. The assessment criteria are guidelines for assessors so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Assessment form** are test and non-test.
8. **Learning form:** Lecture, Response, Tutorial, Seminar or equivalent, Practice, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Lectures** are details or descriptions of topics that can be presented in the form of several main points and sub-topics.
11. **Point weight** is the percentage of assessment for each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **O**=offline, **SA**=Structured Assignments, **IS**=Independent Study

3.3. ELO Weight Calculation Results

No.	Sem.	Code of Subject	Name of Subject	Course Credits	Percentage (%)			
					ELO 2	ELO 3	ELO 4	ELO 5
1.	4	**MK 1529**	Principles of Plant Biotechnology	3	15	10	20	55

3. PLAN OF ASSESSMENT AND EVALUATION

	UPN "VETERAN" JAWA TIMUR AGRICULTURE FACULTY AGROTECHNOLOGY DEPARTMENT BACHELOR DEGREE **PLAN OF ASSESMENT AND EVALUATION** **PRINCIPLES OF PLANT BIOTECHNOLOGY**		**RA & E** **Edisi**
Code: **PG 191115**	**Credits Points**(T/P): (2/1)	**Science Clump:** Biotechnology	**Smt:** 4
AUTHORIZATION	**RA & E Compiler**	**Course Coordinator:** .	**Head of Department**
	Dr.Ir. Makhziah, M.P.	Dr.Ir.Sukendah, M.Sc	Dr.Ir. Bakti Wisnu W., M.P.
Tasks (week to)	**LLO**	**Form Assesment**	**Weight (%)**
2,3	1. Able to apply in-vitro propagation techniques and produce plant seeds from tissue culture.	Task 1: Non test: Doing practice: making solutions and tissue culture media, planting & incubating explants, sub-cultures and acclimatization. (15%) Test: Making questions in essays (5%)	20
4,5	2. Able to explain between tissue culture techniques and plant breeding to produce superior agricultural products.	Task 2: Non test - Make a review of research journals related to somaclonal variation (5%) Test: Making questions in essays (5%)	10
7	3. Be able to explain the devices and techniques of recombinant DNA and the process of gene transformation in genetic engineering.	Task 3: Non test: - Make a research design to develop plant from genetically modified organism (GMO) (Group)(15%) Test: Making questions in essays (5%)	20
9-10	4. Able to explain molecular marker analysis techniques in supporting plant breeding programs.	Task 4: Test - Make questions in essay.	15
11	5. Able to explain and provide arguments about ethics and regulations on biosafety of genetically	Task 5: Non test Discussion on Law no. 21 of 2004 concerning the ratification of the Cartagena protocol, and PP no. 21 of 2005.	5

	engineered products.		
12	6. Able to apply household-scale tissue culture technology and able to produce plant biotechnology products commercially.	Task 6: Non test: - The practice of designing and managing household-scale tissue culture laboratories.	10
13-15	7. Able to apply technopreneurship principles and make a business model canvas for plant biotechnology products.	Task 7 Non-test: Project Base Learning Making a proposal in group for the Student Entrepreneurship Creativity Program (PKM-K) and make the business model canvas for the production of seedlings from tissue culture. (15%) Test: Making questions in essays (5%).	20

4. ASSESMENT RUBRIC

4.1 PRESENTATION OF TASK 7 and 11

ARGUMENT RUBRIC

GRADE	SCORE	PERFORMANCE INDICATORS
GRADE	*SCORE*	*PERFORMANCE INDICATOR*
Very less	<41	The argument doesn't make sense and there's no logical connection
More Less		*The argument*
		• does not make sense and
		• there is no logical relationship
Not enough	41–55	The argument is quite logical, but it doesn't make sense
Less		*The argument is*
		• *quite logical, but*
		• it doesn't make sense
Enough	56– 70	Logical argument, plausible, but less innovative
Enough		*The arguments:*
		• *logical arguments,*
		• *reasonable, but*
		• *less innovative*
Well	71- 85	Logical argument, reasonable, innovative
good		*The arguments:*
		• *logical arguments,*
		• *reasonable, a*nd
		• *innovative*
Very good	86 - 100	Logical argument, innovative and easy
Very Good		implemented in the real world
(Excellent)		*The arguments:*
		• *logical arguments,*
		• *innovative and*
		• can be easily implemented in the real world

4.2 RUBRIC ABILITY IN TEAM COOPERATION

ASSESSMENT OF TEAM WORK

Appraised peer *Peer name be assessed*	…… …….
Assessed Peer NRP *NRP – peer be assessed*	…… …….

No	Rated aspect ***Aspect be assessed***	1	2	3	4	5	6	Value in number (50 – 100) ***Grade in score (50-100)***
1	Teamwork leads to CP achievement (Achievements Learning) *Team work towards achieving LO (Learning Outcomes)*							
2	Demonstrate good interpersonal skills effective *Demonstrate effective interpersonal skills*							
3	Very active in group discussion participation							
4	Sharing of learning resources owned by group member *Sharing of learning resources owned by group members*							
5	Help the group if you miss information compared to other groups *Help groups if they miss information compared to other groups*							
6	Provide constructive feedback (build) and provide solutions if any difficulty *Provide constructive feedback (to build) and provide solutions if there are difficulties*							
7	Work hard for the benefit of the group *Work hard for group interests*							
8	Willing to receive feedback openly (no emotion) *Want to receive feedback openly (not emotionally)*							
9	React positively to positive feedback critical *React positively to criticize feedback*							
10	Manage emotions well *Manage emotions well*							
11	Always stick to his point of view *Always stick to his / her point of view*							
12	Making efforts to improve behavior while working in a group							

	Make efforts to improve behavior while working in groups							
13	Demonstrate the ability to change view in receiving new information *Demonstrate the ability to change views in receiving new information*							
14	Be present at each group work on time *Present on time at each group job*							
15	Demonstrate responsibility and commitment *Demonstrate responsibility and commitment*							
16	Honest *Honest*							

1 = very bad / very non-constructive - very bad / very non-constructive
6 = very good/ very constructive - very good / very constructive

4.3. ANSWER RUBRIC WRITING AN ARTICLE 7

Current Event Article Summary Grading Rubric

CATEGORY	4 - Above Standards	3 - Meets Standards	2 - Approaching Standards	1 - Below Standards
Introduction	The introduction has a strong hook or attention. This could be a strong concept sentence, a relevant quotation, statistic, or question addressed to the reader.	The introduction has a hook or attention grabber. Includes a good concept sentence and/or interesting quote.	The author has a weak introductory paragraph, the connection to the topic is not clear. Paragraph includes a weak concept sentence or quote.	The introductory paragraph is not interesting AND is not relevant to the topic. No concept sentence or quote.
Quotes and Concept Words	All of the examples are specific, relevant and full explanations are given.	Most of the evidence and examples are specific, relevant and explanations are given.	Some of the pieces of evidence and examples are relevant and include an explanation.	Evidence and examples are NOT relevant AND/OR most are not explained.
5 W's	All supportive facts and statistics are reported accurately. Article is fully explained and summarized in own words.	Almost all supportive facts and statistics are reported accurately. Article is mostly explained and summarized in own words.	Some supportive facts and statistics are reported accurately. Weak explanation and summary that is partially plagiarized.	Most supportive facts and statistics were inaccurately reported. Article is poorly explained and summary is mostly plagiarized.
Grammar & Spelling	Author makes no errors in grammar, sentence structure, or spelling that distract the reader from the content.	Author makes 1-3 errors in grammar, sentence structure, or spelling that distract the reader from the content.	Author makes 4-6 errors in grammar, sentence structure, or spelling that distract the reader from the content.	Author makes more than 6 errors in grammar, sentence structure, or spelling that distract the reader from the content.
Conclusion	The conclusion is strong and leaves the reader solidly understanding the writer's response and personal reaction to the article.	The conclusion is good. Includes the author's response and personal reaction to the article.	Conclusion is weak or incomplete. Limited response and personal reaction to the article.	There is no conclusion - the paper just ends.
Proper Format and Organization	Article summary is typed, has a heading, title, and is submitted on time. Summary is organized into 4 or more paragraphs. A challenging newspaper article of sufficient length is attached.	Article summary is typed, has a heading, title, and is submitted on time. Summary is organized into 4 paragraphs. Acceptable newspaper article of sufficient length is attached.	Article summary is typed but submitted late. Incomplete heading and title. Summary has 3 or less paragraphs. Attached item is not a current event newspaper article and/or it is not a sufficient length.	Article summary is not typed. No heading. No article is attached. No title.

5. PROJECT BASE LEARNING

1. Introduction

Propagation of plant tissue culture today has grown rapidly and has several advantages that make a lot of seedlings in a short time, does not require a large place, free of pests and diseases, has exactly the same characteristics as its parent, and uniforms. Tissue culture is also used for generative plant propagation which is difficult to do and can also be used to save embryos (embryo rescue). Therefore, the business of plant tissue culture propagation currently has excellent prospects.

2. Task

Make a business plan for the production of plant seeds from tissue culture in the form of a student-Entrepreneurship Creativity Program (PKM-K) proposal.

a. Choose the right plant commodity, namely a commodity that has a lot of market demand or good market opportunities but there are problems in producing seeds on a large scale.
b. Make business model of canvas as a framework to plan the business activities of production and marketing of tissue culture seedlings with a commodity that has been selected.
c. Make a home-scale tissue culture laboratory design to produce these plant seeds.

3. Proposal Assessment

Assessment of proposal includes: repeatability of topics, weight of intellectual challenges, and emphasis on creativity/substantial aspects.

UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR
FAKULTAS PERTANIAN
JURUSAN AGROTEKNOLOGI – PROGRAM STUDI S-1

SOAL EVALUASI AKHIR SEMESTER GENAP TA 2020/2021

MATA KULIAH	: BIOTEKNOLOGI PERTANIAN
PROGRAM PENDIDIKAN	: S1- PERTANIAN
PROGRAM STUDI/SEMESTER	: AGROTEKNOLOGI/ IV/ Kelas B
HARI/TANGGAL	: Senin/ 21 Juni 2021
SIFAT UJIAN	: TERTUTUP
ONLINE WAKTU	: 90 Menit
DOSEN PENGUJI	: Dr.Ir. MAKHZIAH, M.P.

Capaian Pembelajaran Mata Kuliah (CPMK)

Mahasiswa Semester IV mampu menjelaskan prinsip rekayasa genetika dan pembuatan tanaman transgenik, menjabarkan penanda genetik dan aplikasi penanda molekuler dalam bidang pertanian serta mampu menentukan, mendesain, dan merancang serta melaporkan ide teknopreneurship dan merinci bioetika produk rekayasa genetika di bidang bioteknologi tanaman. (CPMK-C2, CPMK-A2, CPMK-P2, CPMK-P5).

Sub Capaian Pembelajaran Mata Kuliah

1. CPMK-C2. Mampu menjelaskan perangkat dalam rekayasa genetika (enzim, plasmid, gen donor, gen inang) dan penemuan rekayasa genetika untuk penyelesaian suatu masalah, mampu menjelaskan prinsip pemilihan gen donor dan inang bagi peningkatan pangan dan kesehatan lingkungan, mampu menjelaskan macam teknik transfer gen dan perakitan tanaman transgenik, mampu menjabarkan teknik penanda molekuler dan penggunaan penanda genetik dalam biodiversitas tanaman dan *crop improvement* program, mampu merinci prinsip agama, etika dan hukum dalam bidang bioteknologi tanaman serta perlindungan hukum inovasi teknologi dan produk bioteknologi tanaman.
2. CPMK-A2. Mampu melaporkan identifikasi faktor eksternal dan internal serta strategipemasaran usaha/bisnis di bidang bioteknologi tanaman.
3. CPMK-P2. Mampu merancang Bisnis Plan Model Canvas di bidang bioteknologi tanaman.
4. CPMK-P5. Mampu mendesain dan menentukan tentang entrepreneur, teknopreneur dan teknopreneurship serta peluang dan strategi inovasi produk dan teknologi.

SOAL	LO-A2	LO-C2	LO-P2	LO-P5	Bobot nilai
No. 1.		X			20
No. 2		X			20
No. 3		X			20
No. 4		X			20
No. 5		X			20

UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR
FAKULTAS PERTANIAN
JURUSAN AGROTEKNOLOGI – PROGRAM STUDI S-1

TATA CARA UJIAN:

1) **Jawablah pertanyaan di bawah ini dengan ditulis tangan pada lembar folio bergaris.**
2) **Lembar jawaban discan dan dipdfkan.**
3) **Upload/kirim file google classroom.**
4) **Batas waktu ujian dan pengiriman 90 menit tenggang waktu 10 menit.**
5) **Tidak boleh saling mengcopy jawaban antar mahasiswa dan jika ditengarai ada jawaban yang duplikasi maka akan dinilai 0 semuanya.**

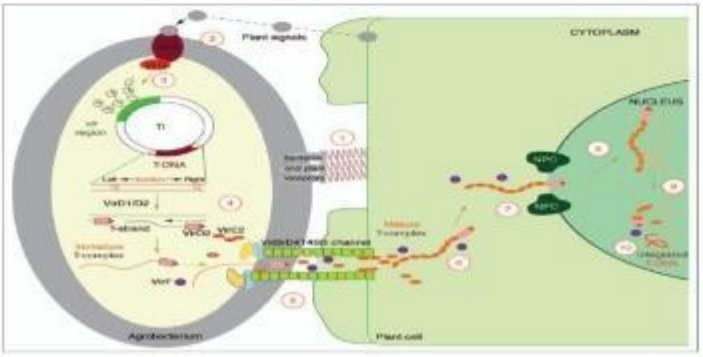
SOAL

1. Manfaat Kultur Jaringan di bidang pertanian selain mendapatkan bibit tanaman dalam jumlah banyak yang seragam, juga mempunyai manfaat lain diantaranya munculnya gejala variasi somaklonal. **(nilai 20)**
   a. Apa yang dimaksud variasi somaklonal dan apa hubungannya dengan pemuliaan tanaman?
   b. Bagaimana cara memperoleh variasi somaklonal?

2. Teknik DNA rekombinan membutuhkan perangkat vektor, enzim restriksi, PCR, cDNA, enzim ligase (**nilai 20**)
   a. Jelaskan tentang DNA rekombinan
   b. Jelaskan karakteristik enzim restriksi yang sering digunakan dalam rekayasa genetika.

3. Pada proses pembentukan DNA rekombinan terdapat beberapa tahap untuk isolasi dan kloning gen target **(nilai 20)**.
   a. Sebutkan tahapan dalam pembentukan DNA rekombinan.
   b. Untuk mendeteksi dan menyeleksi plasmid yang membawa DNA rekombinan maka perlu dilakukan teknik REPLICA PLATING. Jelaskan apa tujuan dari teknik Replica Plating dan bagaimana cara membuat Replica Plating untuk plasmid pBR 322.

4. Teknik transformasi gen ke dalam sel tanaman dapat dilakukan secara langsung maupun tak langsung. Jelaskan mekanisme transformasi gen dari gambar di bawah ini. Teknik apa yang digunakan pada gambar tersebut (**nilai 20**).



A model for the *Agrobacterium*-mediated genetic transformation. The transformation process comprises 10 major steps and begins with recognition and attachment of the *Agrobacterium* to the host cells (1) and the sensing of specific plant signals by the *Agrobacterium* VirA/VirG two-component signal-transduction system (2). Following activation of the *vir* gene region (3), a mobile copy of the T-DNA is generated by the VirD1/D2 protein complex (4) and delivered as a VirD2–DNA complex (immature T-complex), together with several other Vir proteins, into the host-cell cytoplasm (5). Following the association of VirD2 with the T-strand, the mature T-complex forms, travels through the host-cell cytoplasm (6) and is actively imported into the host-cell nucleus (7). Once inside the nucleus, the T-DNA is recruited to the point of integration (8), stripped of its escorting proteins (9) and integrated into the host genome (10). A detailed model of the host cellular mechanisms and the role of plant-specific factors in the transformation process are given in Figure 2. (This illustration was reproduced, with modifications, from [287] with permission.)

UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR
FAKULTAS PERTANIAN
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5. Carilah jurnal penelitian tentang aplikasi penanda molekuler di bidang pertanian, jelaskan teknik penerapan penanda DNA tersebut beserta prosedur dan tujuannya. (**nilai 20**)

Acuan	Soal ini dibuat Oleh	Ditinjau & divalidasi oleh
1. Kurikulum 2. Silabus 3. RPP dan RPS 4.	Dosen Bioteknologi Tanaman: Dr.Ir. Makhziah, MP	 Dr. F.D. Dewanti, S.P. M.P.

Selasa, 22 Juni 2021

Nama : Rosanti Amalia P.
NPM : 1902501006O
Kelas : Agroteknologi B
Matkul : Bioteknologi Pertanian
Dosen Pengampu : Dr. Ir. Makhziah, MP
TTD :

1. a. Variasi somaklonal merupakan variasi genetik tanaman yang dihasilkan dari kultur jaringan atau kultur sel yang meliputi semua variasi genetik yang terjadi pada tanaman. Bagian tanaman yang diregenerasikan berupa sel yang tidak berdiferensiasi, protoplas, kalus ataupun jaringan tanaman.
Hubungannya dengan pemuliaan tanaman adalah dengan adanya variasi somaklonal, dapat terjadi mutasi genetik yang stabil pada tanaman. Hal ini disebabkan oleh terjadinya regenerasi tanaman sehingga menyebabkan perubahan pada kromosom. Sehingga bentuk dan warna daun, laju pertumbuhan, dan fertilitas tanaman ikut ~~be~~ menunjukkan perubahan akibat variasi dalam jumlah dan struktur kromosom. Pemulia tanaman mendapatkan beberapa keuntungan seperti dapat meningkatkan produksi metabolit sekunder, seleksi tanaman, dan membantu perkembangan tanaman.

b. Cara memperoleh variasi somaklonal
Terdapat beberapa teknik untuk mendapatkan variasi somaklonal, diantaranya :
1). Regenerasi langsung
Didapatkan dari eksplan langsung yang diregenerasi tunas adventif dan embrio somatik tanpa melalui sel tunggal. Eksplan kalus tunas adventif tanaman atau embrio diperlakukan dengan cara pemberian mutagen pada eksplan untuk meningkatkan keragaman somaklonal
2). Kultur Sel Tunggal
Merupakan prosedur seleksi melalui kultur sel yang dimulai dari penanaman dan pemilihan eksplan, induksi kalus, isolasi sel, penebaran sel, induksi tunas adventif, dan pemindahan ke lapangan.

3. Kultur Protoplasma

Merupakan salah satu cara untuk memperbaiki poligen yang dejektif terhadap kultivar yang ada. Urutan prosedur ini adalah penyiapan eksplan, isolasi dan purifikasi protoplas, penebaran protoplas, regenerasi protoplas kalus, dan regenerasi planlet.

2. a. DNA Rekombinan merupakan kombinasi dari DNA atau gen-gen yang berasal dari organisme yang berbeda. Proses ini akan menggabungkan gen target dengan plasmid. Fragmen DNA Target dan DNA vektor (plasmid) dicampur atau disambung dengan enzim ligase, apabila hasil yang didapat berupa DNA vektor yang tersisipi DNA dan gen target maka terbentuk DNA rekombinan (DNA kombinasi). Teknologi ini dapat memberikan manfaat bagi perkembangan ilmu pengetahuan, salah satunya adalah produk insulin untuk mengobati penyakit diabetes. Kemampuan bakteri untuk memproduksi insulin disebabkan oleh gen yang dimasukkan dan mampu menyandikan insulin manusia ke dalam genom bakteri.

b. Karakteristik enzim restriksi dalam rekayasa genetika
- Bekerja pada pH 7,4 dengan suhu 37°C
- Memotong DNA pada rangka gula fosfat tanpa merusak basa
- Bersifat palindromik, yaitu sekuen pengenalan yang sama baik dari utas atas maupun utas bawah.
- Enzim restriksi yang mempunyai sekuen pengenalan yang pendek akan menghasilkan banyak potongan DNA, sebaliknya apbila mempunyai sekuen pengenalan yang panjang maka akan menghasilkan potongan DNA yang sedikit.
- Dibagi menjadi tiga berdasarkan perkiraan pemotongan :
  1). 6 cutters : cocok" digunakan untuk kloning sehari-hari karena enzim ini memotong satu atau dua situs pada plasmid
  2). 8 cutters : cocok untuk membentuk kromosom menjadi potongan yang spesifik dalam ukuran besar.
  3). 4 cutters : cocok untuk pemotongan pada beberapa situs yang ideal.

3. a. Tahapan pembentukan DNA rekombinan :
   1). Isolasi gen target
   2). Isolasi plasmid
   3). Ligasi gen target dan plasmid
   4). Transformasi DNA
   5). Screening biru putih
   6). Pembiakan bakteri rekombinan
   7). Purifikasi (panen insulin)

   b. Replica Plating digunakan untuk membedakan atau menyeleksi hanya plasmid yang membawa DNA rekombinan. Cara membuat Replica Plating untuk plasmid pBR322 dimulai dengan tahapan bakteri ditumbuhkan pada media ampicilin, bakteri yang dapat hidup kemudian ditransfer ke membran / kertas nitroselulose sehingga terbentuk pola koloni bakteri yang sama di media ampicilin. Koloni bakteri pada membran dipindah pada media baru yang mengandung tetrasiklin. DNA rekombinan yang tidak membawa gen ketahanan tidak tumbuh sehingga DNA rekombinan yang dapat tumbuh dipindahkan pada media agar yang baru.

4. Teknik transformasi gen yang digunakan pada gambar merupakan jenis transfer gen secara biologis menggunakan Agrobacterium tumefaciens. Mekanisme dari transformasi genetik adalah Agrobacterium memiliki Ti plasmid yang terdiri dari transfer T-DNA, gen vir dan gen untuk katabolisme opin. Induksi dan trasknipsi sederetan gen vir disebabkan oleh senyawa fenolik yang dihasilkan dari pelukaan tanaman. Pengaktifan vir G akibat penyisipan gen-gen pada T-DNA akan menyebabkan pengaktifan gen-gen vir lainnya yang bersifat virulen. Selanjutnya, gen-gen vir akan melakukan transfer vir D untuk memotong situs spesifik pada Ti Plasmid sehingga melepaskan T-DNA. T-DNA membawa gen biosintetik enzim untuk menghasilkan asam amino octopin dan nopalin setelah dihubungkan dengan sel A. Tumefaciens sehingga dapat masuk ke sel tanaman. Dengan mengubah keseimbangan hormon dalam sel tanaman tersebut, bagian sel yang terinfeksi menjadi tidak dapat terkontrol oleh tanaman dan terjadi pembentukan tumor.

5. Judul : Polimorfisme Cabai Rawit dan Cabai Gendot dengan Penanda RAPD Menggunakan Primer OPA-8
Penulis : Eko Purnomo dan Rejeki Siti Ferniah
Tahun : 2018
Jurnal : Berkala Bioteknologi
Vol. : 1 (1)
Tujuan Penelitian : untuk mengetahui keragaman genetik dari sampel cabai gendot dan cabai rawit merah melalui analisis penanda RAPD

Metode yang digunakan :
Isolasi DNA dengan menggunakan Wizard Genomic DNA Purification Kit Promega dan buffer Cetylrimethylammonium bromide (CTAB), lalu sampel diamplifikasi dengan primer OPA-8. Analisis data dilakukan menggunakan perangkat lunak NTSYS dan dihitung indeks kesamaan antarsampel.

No.	NPM	NAMA	NA UTS	NA UAS	NILAI AKHIR
1	19025010045	Eva Tri Agustin	77,8	64,8	71,3
2	19025010046	Diannisa Hanifah Az-Zahra	82,0	68,3	75,1
3	19025010047	Karina Ayu Januariza	78,0	79,9	78,9
4	19025010048	Adella Merlinda Grecia	82,1	82,8	82,4
5	19025010049	Apriliasari Wahyuni	79,5	73,0	76,2
6	19025010050	Galuh Deliana Putri Murda	79,8	71,4	75,6
7	19025010051	Madaniyah	79,6	81,5	80,6
8	19025010053	Dian Safitri	80,0	78,7	79,4
9	19025010054	Aniq Farikha	80,0	81,3	80,6
10	19025010055	Arizka Putri Amalia	80,5	80,5	80,5
11	19025010056	Selvira Mauradilla Utami	80,0	78,1	79,0
12	19025010057	Salsabila Mulianti	82,3	88,8	85,5
13	19025010058	Mochammad Mirza Saputr	85,2	76,1	80,6
14	19025010059	Ayu Sabrina	83,7	91,5	87,6
15	19025010060	Rosanti Amalia Putri	81,3	89,7	85,5
16	19025010061	Azzahra Nasya Safania Ar	81,2	81,2	81,2
17	19025010062	Faizal Aji Priambodo	81,4	88,5	84,9
18	19025010063	Diah Rahmadani	85,3	87,2	86,3
19	19025010064	Melinda Dwi Safitri	81,9	91,7	86,8
20	19025010065	Zumatul Atiko Islamiyah C	82,8	91,3	87,1
21	19025010066	Rafi Kurniawan	83,4	78,9	81,1
22	19025010068	Anita Dwi Saraswati	86,2	88,2	87,2
23	19025010069	Irfan Nurfaiq	85,3	75,5	80,4
24	19025010070	Kholid Ihsan Abdulloh	82,6	74,2	78,4
25	19025010071	Dewa Aldiansyah	81,5	82,2	81,8
26	19025010072	Deva Yudha Rizky Dharma	83,4	76,3	79,8
27	19025010073	Melda Lely Marthalina	83,8	81,2	82,5
28	19025010074	Chelsi Inriyani	82,0	80,1	81,0
29	19025010075	Muhammad Dimas Firmar	81,1	71,3	76,2
30	19025010078	Giyona Galindasukma Har	84,4	84,4	84,4
31	19025010079	Fathimah Azzahra Nurul Ir	82,4	78,5	80,4
32	19025010080	Farikatu Daroini	81,5	82,8	82,1
33	19025010082	Ken Aditya Mahadwi	83,4	66,5	74,9
34	19025010083	Fatimah Lailatus Saadah	83,7	81,8	82,7
35	19025010085	Adhila Zulfa Chairunnisa	85,0	85,0	85,0
36	19025010086	Berlian Safitri	81,4	87,3	84,3
37	19025010087	Anggoro Bayu Aji	79,3	63,7	71,5
38	19025010088	Aufa Aptana Amalia Arif	80,8	82,1	81,4
39	19025010089	Fajril Akbar Firmansyah	79,4	74,2	76,8