Training Course on Genetic Engineering and Gene Editing for Crop Resilience

Professional Development Training Course Outline

Category	Agriculture	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In the face of climate change, food insecurity, and increasing global population, genetic engineering and gene editing have emerged as revolutionary tools to improve crop resilience, boost agricultural productivity, and ensure sustainable farming. Training Course on Genetic Engineering and Gene Editing for Crop Resilience provides a comprehensive understanding of modern biotechnological applications in agriculture, focusing on CRISPR/Cas9 and other advanced gene-editing techniques. Participants will learn how genetic innovations are reshaping the future of crop production by enhancing traits such as drought tolerance, pest resistance, and nutrient efficiency.

The course is designed to build both technical competence and practical insights, equipping participants with the knowledge to implement, regulate, and evaluate genetic solutions in real-world contexts. By exploring successful case studies and the latest scientific breakthroughs, learners will gain the confidence to apply gene editing for sustainable crop improvement, align with regulatory frameworks, and contribute to global food system resilience.

Programme Curriculum

Training Course on Genetic Engineering and Gene Editing for Crop Resilience

Introduction

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Course Objectives

By the end of the course, participants will be able to:

1. Understand the fundamentals of genetic engineering and gene editing in agriculture.
2. Apply CRISPR/Cas9 and other gene-editing technologies for crop improvement.
3. Evaluate genetic traits that enhance climate resilience and yield optimization.
4. Analyze the ethical, regulatory, and biosafety aspects of gene-edited crops.
5. Identify target genes responsible for stress tolerance and nutrient use efficiency.
6. Design gene-editing strategies for disease resistance in crops.
7. Integrate genetic engineering into precision agriculture systems.
8. Interpret genomic data using bioinformatics tools for trait selection.
9. Manage intellectual property rights related to genetically modified organisms (GMOs).
10. Build stakeholder support and communicate science-based benefits of gene-edited crops.
11. Develop field-testing protocols to assess genetic modifications.
12. Collaborate with international researchers and institutions in agri-biotech innovation.
13. Implement gene-editing interventions aligned with sustainable agriculture goals.

Target Audience

1. Agricultural scientists and researchers
2. Plant geneticists and biotechnologists
3. Agronomy students and academics
4. Government agricultural officers
5. Policy-makers in agriculture and food security
6. Biotech startup founders and innovation hubs
7. Seed company professionals and breeders
8. NGOs and extension officers promoting sustainable agriculture

Course Duration: 10 days

Course Modules

Module 1: Introduction to Genetic Engineering

- History and evolution of genetic modification
- Key differences between genetic engineering and conventional breeding
- Core technologies in genetic manipulation
- Applications in major staple crops
- Regulatory landscape overview
- **Case Study**: Golden Rice – Nutritional engineering and public impact

Module 2: Gene Editing Technologies

- CRISPR/Cas9 mechanism and workflow
- TALENs and ZFNs comparison
- Target site selection and validation
- Editing efficiency and precision
- Limitations and off-target effects
- **Case Study**: CRISPR-edited wheat for fungal resistance

Module 3: Crop Stress Tolerance Engineering

- Identifying genes for abiotic stress resistance
- Engineering drought and salinity tolerance
- Role of transcription factors and promoters
- Laboratory to field transition
- Evaluating edited crop performance
- **Case Study**: Drought-tolerant maize in sub-Saharan Africa

Module 4: Pest and Disease Resistance

- Genetic control of viral, fungal, and bacterial pathogens
- Engineering insect-resistant crops
- RNAi technology applications
- Biosafety and gene flow concerns
- Long-term impact on ecosystem and biodiversity
- **Case Study**: Bt brinjal in Bangladesh

Module 5: Nutritional Enhancement

- Biofortification through gene editing
- Genetic pathways of vitamin and mineral synthesis
- Consumer health benefits and market acceptance
- Regulatory and labeling issues
- Future trends in functional foods
- **Case Study**: Iron-fortified cassava in West Africa

Module 6: Bioinformatics and Genomic Tools

- Genomic databases and gene annotation
- Designing guide RNAs for CRISPR
- Software tools for target validation
- Data interpretation and visualization
- Integrating omics data for trait selection
- **Case Study**: Genome-wide association studies (GWAS) in rice

Module 7: Precision Agriculture Integration

- Combining gene editing with IoT and sensors
- Phenotyping for edited traits
- Decision support systems
- Site-specific farming approaches
- Enhancing smallholder farmer productivity
- **Case Study**: Precision biotech farming in Kenya

Module 8: Regulation and Policy

- National and global regulatory frameworks
- GMO vs gene-edited crop classification
- Public perception and misinformation
- Risk assessment and biosafety evaluation
- Harmonizing policies for trade and innovation
- **Case Study**: USDA’s regulation of gene-edited crops

Module 9: Ethics and Public Engagement

- Ethical concerns in plant gene editing

- Inclusive innovation and farmer rights
- Gender and access to biotech tools
- Community engagement strategies
- Building public trust in GM crops
- **Case Study**: Stakeholder dialogue in Nigeria's GM cowpea approval

Module 10: Intellectual Property and Licensing

- Patents in gene-editing technology
- Access and benefit-sharing
- Licensing models for public research
- Legal conflicts and resolution
- Protecting indigenous genetic resources
- **Case Study**: CRISPR patent wars and implications for developing nations

Module 11: Field Trials and Testing

- Design of controlled field trials
- Environmental risk assessment protocols
- Data collection and statistical analysis
- Monitoring edited traits across seasons
- Reporting and compliance procedures
- **Case Study**: Open-field testing of gene-edited tomato in Brazil

Module 12: Seed Systems and Commercialization

- Seed multiplication and certification
- Market readiness and value chains
- Private-public partnership models
- Farmer training and outreach
- Ensuring trait stability across generations
- **Case Study**: Hybrid gene-edited sorghum in Ethiopia

Module 13: Climate-Smart Agriculture and Resilience

- Linking gene editing with SDGs
- Enhancing crop adaptability to changing climates
- Water use efficiency and soil health
- Carbon footprint of biotech crops
- Policy incentives for climate-resilient technologies
- **Case Study**: Climate-resilient rice in Southeast Asia

Module 14: Innovation Hubs and Startups

- Accelerators and biotech incubators
- Funding and investment opportunities
- Startup ecosystem in agri-biotech
- Innovation pipelines and IP transfer
- Collaboration with academic institutions
- **Case Study**: African ag-biotech startup success stories

Module 15: Future of Plant Biotechnology

- Synthetic biology in agriculture
- AI and machine learning in gene discovery
- Nanotechnology-assisted gene delivery

- Global trends and foresight analysis
- Preparing for next-gen gene editing
- **Case Study**: Synthetic wheat genome assembly

Training Methodology

- Expert-led interactive lectures
- Hands-on lab and bioinformatics sessions
- Real-world case study analysis
- Group-based innovation challenges
- Field visit or virtual simulations
- End-of-course capstone project

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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