



MNS UNIVERSITY OF AGRICULTURE, MULTAN
REGISTRAR OFFICE: ACADEMICS SECTION
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No: MNS-UAM/RO(A)-38/962

Date: 15.12.2022

NOTIFICATION

The Syndicate in its 35th meeting held on 19.11.2022 has approved the recommendations made by the Academic Council in its 9th meeting held on 02.11.2022, regarding revisions in scheme of studies of Master of Science (Honours) and Doctor of Philosophy (PhD) Seed Science and Technology from session 2023 and onwards (as per attached Appendix).

Aisha Bibi

Deputy Registrar (Acad.)

For Registrar

Distribution: -

- Director Quality Enhancement Cell
- Dean Faculty of Agriculture and Environmental Sciences
- Director Graduate Studies
- Director, Institute of Plant Breeding and Biotechnology
- Controller of Examinations
- Treasurer
- Deputy Registrar (HR)
- Secretary to the Vice Chancellor
- Office File

REVISION IN SCHEME OF STUDIES



MASTER OF SCIENCE (HONOURS) AND DOCTOR OF PHILOSOPHY (PhD) SEED SCIENCE AND TECHNOLOGY

Approved vide	Meeting	Date
Academic Council	9 th	02.11.2022
Syndicate	35 th	19.11.2022

FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCES

MNS UNIVERSITY OF AGRICULTURE, MULTAN

Course Contents

Approved

SST-701 Environmental factors and seed crop production 3(2-1)

Learning Objectives

Students will learn:

- Techniques and strategies for good quality seed production under various stressed environments.
- Influence of environmental factors on plant growth, seed yield and quality.
- Ways and strategies to produce good quality seed under hostile environments.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Elaborate methods of quality seed production under various environments	Cognitive
2	Describe the approaches for stress management in seed crops	Cognitive
3	Application of acquired knowledge for improving seed crop production	Psychomotor

SDGs addressed in the course:

SDG 2: Zero hunger

SDG 4: Quality education

Teaching Mode: Blended learning

Course Contents

Theory

Climate, Environment and its components; Fundamentals of seed production and crop yield components; Phases of seed development; Crop management and seed yield; Role of abiotic factors (water, minerals, temperature and light) and biotic factors (insect pests, plant and soil microorganisms, weeds) in seed development, production, and quality; Relation of pollinators with environmental factors; Physical and biological factors affecting seed distribution and survival; Climate change and its impact on seed production and quality; Breeding for climate change; Innovative approaches for stress management in seed crop.

Practical

Field and laboratory study of stress parameters; Identification of symptoms of biotic and abiotic stress on crop plants; measuring effects of stresses on seed germination, viability and vigor; Screening under simulated stress conditions; Data analysis of tolerance related traits and report writing.

Text Book

1. McDonald, M.B. and L. Copeland. 1998. Seed Production: Principles and Practices. CBS Publishers and Distributors, New Delhi, India.

Approved

Suggested Readings

1. Bewley, J.D., K.J. Bradford, H.W.M. Hilhorst and H. Nonogaki. 2013. Seeds: Physiology of Development, Germination and Dormancy. 3rd Ed. Springer, New York, NY, USA.
2. Copeland, L.O. and M.B. McDonald. 2001. Principles of Seed Science and Technology. 4th Ed. Kluwer Academic Publishers, Norwell, MA, USA.
3. Hakeem, K.R. (Ed.) 2015. Crop production and global environmental issues. Springer International publishing Switzerland.
4. Singhal, N. C. 2003. Hybrid Seed Production in Field Crops: Principles and Practices. Kalayani Publishers, New Delhi, India.
5. Taiz, L. and E. Zeiger. 2010. Plant Physiology. 5th Ed. Sinauer Associates Inc. Sunderland, Massachusetts, USA.

SST-702

Variety and Seed Legislation

3(2-1)

Learning Objectives

Students will learn:

- Proprietary rights and laws, and their use in seed industry.
- National and international laws for seed production.
- Variety approval and seed certification system of Pakistan.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Explain national seed acts and rules	Cognitive
2	Describe seed certification systems of international agencies	Cognitive
3	Apply knowledge for business registration and seed certification	Psychomotor

SDGs addressed in the course:

SDG 2: Zero hunger

SDG 4: Quality education

Teaching Mode: Blended learning

Course Contents

Theory

Introduction to Legislation; IPR in seed industry: issues and challenges; Plant Variety Protection laws; Plant Breeder's Rights; Cartagena protocol on biosafety, legislation for transgenic seed; IPO; National and international organizations involved in seed business, trade, import and export; Plant varieties registration; Seed act, Seed act amendments; Seed business rules; Quality standards for seed certification; Key elements of seed regulatory systems; Seed certification: National and international systems; Phytosanitary measures; Label certification; International seed testing associations; International rules for trade and arbitration.



Approved

Practical

Filling request for field inspection; request for seed sampling; Procedure of field inspection and seed sampling; Filing of seed act violation cases; Procedure for registration of seed business; Filing appeal; application for plant breeder rights

Textbooks

1. Qureshi, Q.M. 2019. Seed certification Hand book. FAO and FSC&RD, MNFSR, Islamabad.

Suggested Readings

1. Agrawal. 1995. Seed Technology (Part 3). Oxford and IBH Publishing Company Pvt. Limited, New Delhi, India.
2. Dutfield, G. 2002. Intellectual Property Rights Trade and Biodiversity: Seeds and Plant Varieties. Earthscan Publications Ltd., London, UK
3. Helfer, L.R. 2004. Intellectual Property Rights in Plant Varieties: International legal regimes and policy options for national governments. FAO Legislative Study 85, Food and Agriculture Organization of United Nations, Rome, Italy.
4. Md. Huda, N. and I. Md. Saiyed. 2011. Quality seed in SAARC Countries: Production, Processing, Legal and Quality Control and Marketing System. SAARC Agriculture Centre. Momin Offset Press, Dhaka, Bangladesh.

SST-703 Seed Health Management and Quarantine Measures 3(2-1)

Learning Objectives

Students will learn:

- Seed borne diseases and their impacts on seed health
- Skills of seed health testing
- Modern techniques to maintain seed health during seed development, processing and storage.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Explain seed borne diseases and their preventive measures	Cognitive
2	Discuss the most suitable seed testing methods with practical learning	Cognitive
3	Apply knowledge of quarantine measures to prevent the spread of seed borne diseases and pathogens	Psychomotor

SDGs addressed in the course:

SDG 2: Zero hunger

SDG 8: Decent work and economic growth

Teaching Mode: Blended learning

Course Contents

Theory

Introduction to seed borne; Transmission of seed borne pathogens and diseases; Production of mycotoxins by seed borne pathogens; Impact of climate on development of seed borne diseases;

Approved

Factors affecting the transmission of seed borne pathogens; Seed health testing: conventional and modern methods Abiotic and biotic factors affecting seed health during storage; Seed health management: Principle and approaches; Insect resistant seed packaging; Fumigation of seed storages; Controlled atmospheric technology for seed storage; Principles of plant quarantine and sanitary and phyto-sanitary (SPS) measures; International and domestic quarantine standards and rules; Biosecurity, disease reporting, legislative framework; Detection of pathogens in import/export consignment; Procedure and measure adopted under National Animal and Plant Health Inspection Services in Pakistan.

Practical

Determination of seed infection: physical examination; Conventional methods of detection and identification used for seed borne pathogens; Use of modern techniques for detection of pathogens (PCR, ELISA, Stripe test); Isolation and detection of fungi, bacterial, viruses, and nematodes; Seed treatment methods; Techniques for insect detection; Demonstration of fumigation techniques for seed storage; Visit of quarantine facility.

Text Book

1. Ebbels, D.L. 2003. Principles of Plant Health and Quarantine. CABI Publishing, London, UK.

Suggested Readings

1. Agarwal V.K. 2006. Seed Health. International Book Distributing Co., Lucknow, Uttar Pradesh, India.
2. Hagstrum, D.W., T.W. Philips and G. Cuperus, 2012. Stored Product Protection, Kansas State Univ. Agric. Exp. Station and Coop. Extension Service, Manhattan, KS, USA.
3. Mathur, S.B. and O. Kongsdal, 2013. Common Laboratory Seed Health Testing Methods for Detecting Fungi. ISTA, Bassersdorf, Switzerland.
4. Sastry, K.S. 2013. Seed-borne Plant Virus Diseases. Springer, New Delhi, India.

SST-704 Quality Assurance Systems in Seed Industry 3(2-1)

Learning Objectives

Students will learn:

- Quality control measures for laboratories and seed industry.
- Procedures for producing high quality seed.
- Steps of quality assurance mechanism for seed industry

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Describe the quality assurance system of seed industry	Cognitive
2	Implement quality assurance measures for quality seed production	Psychomotor

SDGs addressed in the course:

SDG 2: Zero hunger

SDG 4: Quality education



Teaching Mode: Blended learning**Course Contents****Theory**

Quality assurance system for seed production, harvesting, processing and storage in seed industry; Organizing seed quality data for use in industry; The application of total quality management for seed laboratories and seed business; Production planning process: Planning for operating capital constraints, advancement systems and prioritizing farmer needs; Production of high quality seed; Protection of genetic integrity; Identification and labeling of plants, fields and areas for quality seed production; Role of EGS (Early Generation Seed) system in quality seed production; Metrics for breeder performance; Focusing R&D in rapidly advancing technology; Pre and post control trials as a check on seed multiplication system; Factors contributing seed contamination; Seed act enforcement in quality assurance of seed.

Practical

Quality assurance infrastructure; Seed sampling; Quality lab components; Sample receiving; Record keeping; Tagging; Retesting; Internal audits; Identification of contaminants during seed testing; Field inspection; Field and seed standards of crops

Text Book

1. Chakrabarti, S.K. 2010. Seed Production and Quality Control. Kalyani Publishers, New Delhi, India.

Suggested Readings

1. Agrawal, R.C. 1998. Fundamentals of Plant Breeding and Hybrid Seed Production. Science Publications Inc. New York, NY, USA.
2. Basra, A.S., 1995. Seed Quality: Basic Mechanisms and Agricultural Implications. CRC Press, Florida, FL, USA.
3. Joshi, A.K. and B.D. Singh. 2003. Seed Science and Technology. Kalyani Publishers, New Delhi, India.
4. Kulkarni, G.N. 2004. Principles of Seed Technology. Kalyani Publishers, New Delhi, India.
5. Md. Huda, N. and I. Md. Saiyed. 2011. Quality seed in SAARC Countries: Production, Processing, Legal and Quality Control and Marketing System. SAARC Agriculture Centre. Momin Offset Press, Dhaka, Bangladesh.
6. Natarajan, V.N., K. Natarajan, A. Bharathi, R. Umarani, and T. Sarvanan (eds.). 2008. Advances in Seed Science and Technology, Vol. I: Recent Trends in Seed Technology and Management. Agrobios, Jodhpur, India.

SST-705 Seed Business Management and Entrepreneurship 3(2-1)

Learning Objectives

Students will learn:

- Seed business and seed supply chain systems.
- Seed business plans and evaluation of marketing decisions.
- Potentials of seed entrepreneurship in Pakistan.

Approved

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Describe different forms of seed business organization	Cognitive
2	Elaborate the principles for seed business management	Cognitive
3	Apply entrepreneurship strategies for effective seed business	Psychomotor

SDGs addressed in the course:

SDG 4: Quality education

SDG 8: Decent work and economic growth

Teaching Mode: Blended learning

Course Contents

Theory

Introduction and fundamentals of seed business; Managerial roles and skills required for seed business management; Managerial tasks in seed business management: planning, organizing, leading and controlling; Forms of seed business organization: sole proprietorship, partnership, company and cooperatives; Use of economic principles in seed business: Profit maximization principles and cost minimization principle; Marketing strategies for seed industry: Strengths, weaknesses, opportunities, threats (SWOT) analysis, customer relationships management, product development and supply chain management, pricing and credit decisions and promotional planning; Tools for evaluation of marketing decisions in seed business; entrepreneurship in seed sector; Avenues of entrepreneurship in public and private sector; Entrepreneurship development and strategies; Seed Business Plan: Contents and format; Understanding the financial statements of seed firms and forecasting financial requirements; Human resource management and its issues in seed sector; International seed business: challenges and key factors for success; Overview of seed business in Pakistan; public and private seed enterprises: role and functions; Seed distribution channels in Pakistan; Case studies and visits of seed companies in Pakistan.

Practical

Orientation of business plan components and structure of business plan; Preparation of business plans; Development of detailed feasibility report of business idea or business plan; Environmental assessment and preparation for a new venture; Educational and social entrepreneurship role in the economic development of a country; preparation of projected financial statements and application of ratio analysis to determine the financial viability of the chosen project; Legal compliances and types of emerging ventures in Pakistan; Presentations of selected innovative business idea and plan.

Text Book

1. Akridge, J.T., F.L. Barnard, F.J. Dooley and J.C. Foltz. 2012. Agribusiness Management. Routledge Publishers, Abingdon UK.



Approved

Suggested Readings

1. David, D., V. Fleet, E. W. Fleet and G. J. Seperich. 2014. Agribusiness: Principles of Management. DELMAR Cengage Learning, New York, NY, USA.
2. Haque, N. 2007. Entrepreneurship in Pakistan. Pakistan Institute of Development Economics, Islamabad, Pakistan.
3. Mohy-ud-Din, Q. and H. Badar. 2011. Marketing of Agricultural Products in Pakistan: Theory & Practice. Higher Education Commission (HEC), Islamabad, Pakistan.
4. Rana, M.A. 2014. The Seed Industry of Pakistan: Regulation, Politics and Entrepreneurship. PSSP/IFPRI Working Paper No. 19. Islamabad, Pakistan.

SST-706

Advances in Seed Production

3(2-1)

Learning Objectives

Students will learn:

- Recent innovations in seed production of crops
- Principles and procedures for producing hybrid seed/variety.
- Modern biotechnological tools necessary for quality seed production.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Demonstrate knowledge of advanced technologies involved in hybrid seed production.	Cognitive
2	Describe biotechnological approaches for quality seed development.	Cognitive
3	Apply the innovations in seed technology for solving the problems advanced seed production.	Psychomotor

SDGs addressed in the course:

SDG 1: No poverty

SDG 2: Zero hunger

SDG 4: Quality education

Teaching Mode: Blended learning

Course Contents

Theory

Concept and significance of quality seed production; Seed production principles and requirements; Role of growth hormones and nutrients in quality seed production; Management strategies for seed production under changing climate; Systems of hybrid seed production: development and maintenance of inbred and restorer lines; BLA technology for hybrid seed production; Heterosis: quantitative and molecular approaches for understanding heterosis; Isolation, planting ratios and synchronization of male and female parents; Genetic purity, harvesting and handling of hybrid seeds; Problems of hybrids; Technological advances in seed processing and preservation; Genetically modified (GM) seed: development and production approaches; Biotechnological tools in hybrid seed development and production;

Approved

Practical

Maintenance and evaluation of inbred lines; Induction of male sterility; Selection and maintenance of A, B and R lines of various crops under field conditions; Pre-requisites for plant transformation, methods of plant transformation; Rouging practices for quality seed production; Screening and selection of putative GM plants; Maintenance and multiplication of GM seeds.

Text Book

1. Krishnan, M. 2016. Plant Breeding and Hybrid Seed Production. Black Prints, India.

Suggested Readings

1. Das, D.K. 2014. Seed Technology and Hybrid Seed Production. Astha Pub., New Delhi, India.
2. Feistritzer, W.P. and A.F. Kelly. 1987. Hybrid Seed Production of Selected Cereal, Oil and Vegetable Crops. FAO Plant Production and Protection Paper 82, Food & Agri. Organization of the United Nations, Rome, Italy.
3. Tiwari, A. 2020. Advances in Seed Production and Management. Springer Nature, Singapore.
4. Singhal, W.C. 2015. Hybrid Seed Production. 2nd Ed. Kalyani Publishers, New Delhi, India.
5. Vanangamundi, K. and A. Vijayakumar. 2014. Hybrid Seed Production of Agronomic Crops. Agrobios Pub., New Delhi, India.

SST-707

Seed Biotechnology

3 (2-1)

Learning Objectives

Students will learn:

- **Role of biotechnology in quality seed production and storage.**
- **Benefits of hybrid seed and transgenic seed over traditional farming.**
- **Different biotechnological tools for seed molecular testing.**

Course Learning Outcomes

Sr. No.	CLOs	Domain
1	Explain the molecular mechanisms behind seed development and programmed cell death.	Cognitive
2	Integrate the use of advanced biotechnological tools in hybridization, transformation and seed storage into the traditional farming systems.	Psychomotor
3	Apply advanced strategies to ensure quality seed and identify future avenues of research in seed biotechnology.	Psychomotor

SDGs addressed in the course:

SDG 2: Zero hunger

SDG 4: Quality education

Teaching Mode: Blended learning

Course Contents**Theory**

Role of biotechnology in seed bank and conservation of genetic diversity, epigenetic control of seed gene imprinting. Development of the suspensor: differentiation, communication, and programmed cell death during plant embryogenesis. Molecular markers and their applications in breeding programs. Quantitative trait loci and gene mapping, Whole genome sequencing. Transition from marker assisted selection to genomic selection. Molecular biology of seed pathogens and insects: seed molecular virology, bacteriology, mycology and entomology. Transgenic seed vs hybrid seed: role of transgenic technology in seed and hybrid seed development. DNA fingerprinting for varietal identification. Seed molecular farming: molecular farming for vitamins, therapeutics, nutraceuticals and vaccines etc.

Practical

DNA Extraction, PCR, Gel Electrophoresis, Primer Designing, Construction of Genetic Maps, ELISA Assay.

Text Book

1. Weber, H., N. Sreenivasulu and W. Weschke. 2010. Plant Developmental Biology-Biotechnological Perspectives. *In*: E.C. Pua and M.R. Davey Vol. 2 (Eds.). Springer-Verlag Berlin Heidelberg, Germany.

Suggested Readings

1. Benedikt, H. and K.H. Brian. 2011. Epigenetics: Linking Genotype and Phenotype Development and Evolution. University of California Press. California, CA, USA.
2. Brown, T.A. 2016. Gene Cloning and DNA Analysis: An Introduction; 7th Edition, John Wiley and Sons Ltd., Chichester, UK.
3. Sabelli, P.A. and B.A. Larkins. 2015. Advances in Seed Biology. Frontiers Media SA, Lausanne, Switzerland.

SST-708 Statistics in Seed Research 3(1-2)**Learning Objectives**

Students will learn:

- Various techniques of statistics required for seed research programs.
- Use of spreadsheets and statistical packages for data analysis.
- Skills in data collection, analysis and to draw inference from the results.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Explain the basic concepts of probability, statistical inference, regression and correlation.	Cognitive
2	Apply new tools for handling large data sets.	Psychomotor
3	Summarize the research findings and their interpretation.	Psychomotor

SDGs addressed in the course:

SDG 4: Quality education

SDG 8: Decent work and economic growth

Approved

Teaching Mode: Blended learning

Course Contents

Theory

Introduction to statistics and its use in seed research; Descriptive statistics, probability, chi-square test, contingency tables; Genetic and environmental components of variation; Genotype × environment interaction; Heritability and response to selection, selection indices and their uses; Regression and correlation analysis; Linear and logistic regression; Principal components analysis; Exploratory data analysis and inference.

Practical

Assumptions underlying the data; Transformation of data; Estimation of genotypic and phenotypic correlations; Estimation of genetic components, heritability and genetic advance from different mating designs; Stability analysis; Use of statistical softwares for data analysis and interpretation; Cluster and Biplot analysis.

Textbook

1. Dean, A., D. Voss and D. Draguljic. Design and Analysis of Experiments. 2017. 2nd Edition. Springer International Publishing AG, Switzerland.

Suggested Readings

1. Bonamente, M. 2017. Statistics and analysis of scientific data. Springer Springer, New York, USA.
2. Falconer, D.S. and T.F.C. Mackay. 2009. Introduction to Quantitative Genetics. Pearson Education, New York, NY, USA.
3. Kang, M.S and M. Kang (eds). 2003. Handbook of Formulas and Software for Plant Geneticists and Breeders. Harworth Press Inc., Binghamton, NY, USA.
4. Rosner, B. 2010. Fundamentals of Statistics. 7th Ed. Brooks/Cole, CENGAGE Learning, Boston, USA.
5. Singh, R.K. and B.D. Chaudhary. 1997. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Publishers, New Delhi, India.

SST-709

Post-harvest Physiology of Seeds

3(2-1)

Learning Objectives

Students will learn:

- The principles and practices employed to maintain the quality of seed and propagation materials.
- The physiological mechanism of seed deterioration and enhancements.
- Post-harvest management for handling of seeds.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Elaborate the practices required to maintain seed quality	Cognitive
2	Describe the physiological mechanisms of seed deterioration	Cognitive
3	Apply Post-harvest management techniques for maintaining seed quality	Psychomotor

SDGs addressed in the course:

SDG 4: Quality education

SDG 8: Decent work and economic growth

Teaching Mode: Blended learning

Course Contents

Theory

Concept of post-harvest physiology; Seed structure and composition; Post-harvest losses: economic, quantitative and qualitative; Factors responsible for post-harvest losses; Postharvest losses prevention; timeliness of farm operation including; harvesting and evacuation of produce from the farm; Physiological maturity and harvest maturity indices of crop seeds; After-ripening; Post-harvest management such as drying, cleaning, sorting, grading, treatment, packaging, appropriate handling, transportation of produce in different containers; Fundamentals and principles of seed storage; Modern and traditional methods of Environmental control on the rate of seed respiration during storage: humidity, temperature, air and gases; Physiology of seed deterioration: ROS and oxidative stress; Seed enhancements; Physiology of seed enhancements.

Practical

Seed moisture determination; Biochemical tests of seed viability; Controlled deterioration test; Determination of physiological indices of seed deterioration; Demonstration of seed enhancements for abiotic stress tolerance; Visit of seed storage facility

Textbook

1. Bewley, J.D., K.J. Bradford, H.W.M. Hilhorst and H. Nonogaki. 2013. Seeds: Physiology of Development, Germination and Dormancy. 3rd edition. Springer, New York, NY, USA.

Suggested Readings

1. Benceh-Arnold, R.L. and R.A. Sanchez. 2004. Handbook of Seed Physiology. Application to agriculture. Haworth Press. New York, NY, USA.
2. Black, M., J.D. Bewley and P. Halmer. (eds.) 2006. The Encyclopedia of Seeds: Science, Technology and Uses. CABI, USA.
3. Copeland L.O. and M.F. McDonald. 2001. Principles of Seed Science and Technology. 4th Eds. Burgess Pub. Co., UK.
4. Desai, B.B. 2004. Seeds Handbook: Biology, Production, Processing and Storage. 2nd Ed. Marcel Dekker, Inc., New York, NY, USA.
5. Taize, L. and E., Zeiger. 2006. Plant Physiology 4th Ed. Sinauers Associate, Inc. Sunderland Massachusetts, USA.

SST-710 Seed and Agricultural Marketing 3(3-0)

Learning Objectives

Students will learn:

- Seed marketing concepts, methods, strategic issues and risks associated with business enterprises

Approved

- Critically discuss models of basic seed marketing system.
- Indicators of marketing efficiency and legislations related to marketing.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Describe different seed marketing approaches	Cognitive
2	Elaborate the working mechanism of public and private seed industry	Cognitive
3	Explore seed marketing problems for effective seed business	Psychomotor

SDGs addressed in the course:

SDG 4: Quality education

SDG 8: Decent work and economic growth

Teaching Mode: Blended learning

Course Contents

Theory

Concepts and definitions of market, marketing of agricultural products; Classification and scope of input/seed markets; Role of seed marketing in economic development; Factors responsible for neglecting of input/seed marketing; Market Development approaches; The functional approach, The institutional approach, The commodity approach, The behavioral system approach, Market structure approach, Market conduct approach, Market performance approach; Marketable and marketed surplus of agricultural inputs; Market channels and distribution system of various kind of seeds; Seed marketing practices in Pakistan; Standardization and grading, marketing information, market legislation, market committees; Management of input markets; Prices mechanism of seed industries; Seed marketing problems in Pakistan.

Practical

Seed market visit and identifying the seed value chain system in Pakistan of various commodities.

Textbook

1. Kotler, P. and G. Armstrong. 2008. Principal of Marketing. 12th Ed. Prentice-Hall International, Inc., New Jersey, NJ, USA.

Suggested Readings

1. Sharma, P. 2022. Marketing of Seeds. Gene-tech Books, New Dehli. India.
2. Kohls, R.L. and J.N. Uhl. 2002. Marketing of Agricultural Inputs. 7th Ed. MacMillan Publishers, New York, NY, USA.
3. Mohy-ud-Din, Q and H. Badar. 2012. Marketing of Agricultural Products in Pakistan: Theory & Practice. Higher Education Commission (HEC), Islamabad, Pakistan.

SST-711

Plant Nutrition for Seed Crops

3(2-1)

Learning Objectives



Approved

Students will learn:

- Role of plant nutrition in seed production.
- Factors affecting availability of nutrients to the plants.
- Nutrient management strategies for producing good quality seed.

Course Learning Outcomes

Sr. No.	CLOs	Domains
1	Comprehend the role of plant nutrition in seed development	Cognitive
2	Describe the nutrient determination techniques in seed	Cognitive
3	Apply nutrient supplementation strategies for producing good quality seed.	Psychomotor

SDGs addressed in the course:

SDG 1: No poverty

SDG 2: Zero hunger

SDG 4: Quality education

Teaching Mode: Blended learning

Course Contents

Theory

Concepts of soil fertility and productivity, Plant nutrition: essential plant nutrients, nutrient transformations; Nutrient cycling; Movement of ions from soil to roots: Diffusion, mass flow and root interception; Nutrient uptake; Role of plant nutrients in seed production; Factors affecting soil fertility and plant nutrition: Soil factors, plant factors, environmental factors-4R nutrient management for better seed production: Right dose, right source, right time, right application method. Integrated nutrient management practices for seed crops; Nutrient conservation strategies: Stubble management and green manuring; Nutrient sources for organic seed production; Nutrient and plant disease interactions: Preventive and curative role of nutrients under abiotic stresses; Enhanced efficiency fertilizers (EEF) and seed production: slow/controlled released fertilizers, Biofertilizers

Practical

Plant sampling for nutrient analysis, Determination of nutrients in plant and seed samples; Soil sampling techniques; Determination of soil nutrient profile; Deficiency symptoms of plant nutrients; Preparation of nutrient solutions.

Text Book

1. Barker, A.V. and D.J. Pilbeam (Eds.). 2015. Handbook of Plant Nutrition. 2nd Ed. CRC Press, Taylor and Francis Group, Boca Raton, Florida. FL, USA.

Suggested Readings

1. Elsworth, L. and W.O. Relay (eds.). 2009. Fertilizers: Properties, Applications and Effects. Nova Science. Publ. Inc., New York, USA.
2. Havlin, J.L., J.D. H. Beaton, S.L. Tisdale and W.L. Nelson. 2005. Soil Fertility and Fertilizers. 7th Ed. Pearson Education, Singapore.
3. Mengel, K. and E.A. Kirkby. 2001. Principles of Plant Nutrition. 5th Ed. Kluwer Academic Publishers, Dordrecht, The Netherlands.