Subject Module
Department of Agrotechnology
Faculty of Agriculture
University of Islam Malang

Module Handbook

Module Title	Soil Fertility and Quality
Module Level, if available	Undergraduate Study Program of Agrotechnology
Subject Code	MKW 60621
Headings, if available	-
Subject (MK)	Soil Fertility and Health
Semester	3
Subject Coordinator	Dr. Ir. Nurhidayati, MP.
Teaching Team	-
Language of instruction	Indonesian language/English
Linkages with the Curriculum	Study Program : Agrotechnology Specialization: Agrotechnology Type: Compulsory/~~elective~~
Learning Methods and Duration	1. Lecture: 100 minutes/meeting (14 meetings) **2.** Research-Based Learning through Field and laboratory practice 170 minutes/meeting (8 meetings) 3. Structured Assignments/individual and group Assigments presentation
Student Study Load	1. Lecture: 100 minutes/meeting (14 meetings) 2. Field and laboratory practice: 170 minutes/meeting (8 meetings) 3. Structured Assignments/quiz/group presentation 4. Attendance: 75% of total attendance
Credit Weight	3 credits or 5.1 ECTS
Requirements for Passing the Subject	• Attendance >75% • The final score of all the components of the learning evaluation >44 The final score component: • 20% Midterm Exam • 20% Final Exam • 30% Practicum • 20% Structured Assignments (individual and group) • 10% Presence
Prerequisite Subjects	Basic Soil Science
Learning Outcomes	The expected learning outcomes are: 1. Having a good and deep knowledge in the disciplines of basic agricultural sciences that support Agro-technology field (ILO 3) 2. Able to solve problems that arise in the field of agrotechnology and related fields of science (ILO 5) 3. Able to apply agricultural practices based on *Good Agricultural Practices* (ILO 8)

	4. Able to manage plant production system (ILO 9) 5. Able to work independently or in a team, and use various methods of communication (ILO 4)
Learning Content	After completing this Subject students are able to: 1. understand the theoretical concepts of soil fertility, quality, and health and their application in sustainable crop production systems 2. identify the practical problem of nutrient availability in the soil and find solutions to increase the availability of nutrients in the soil 3. assess soil fertility, quality, and health with standard methods in the agricultural land and formulate practical problems related to soil fertility, health, and quality **4.** evaluate the impact of agricultural practices on soil fertility, quality, and health **5.** recommend appropriate soil management strategies based on practical problems of soil fertility and quality to increase agricultural productivity The topics include: 1. Introduction • Scope and concept of soil fertility and health • Principles for managing soil fertility, soil health, and quality 2. Components of the agricultural Soil Affecting Soil Fertility • The mechanism of releasing nutrients from four nutrient sources in the soil • Factors affecting ion concentration in soil solution • The role of the CEC in soil fertility and its management 3. The Relationship of Soil and Plants • The mechanism of nutrient supply from nutrient sources into the soil solution • Mechanisms for supplying nutrients to plant roots and uptake of plant nutrients • Factors affecting nutrient availability 4. Soil acidity and alkalinity • Sources of soil acidity • Soil as a buffer capacity • Active vs. Potential Acidity • How to solve the problem of soil acidity • Soil alkalinity • Alkaline soil problems 5. Application of Liming on Acid Soil • Types of lime • Practice calculating the lime requirement for agricultural land • Liming of acid soils • Analyze the collected data of liming treatment based on plant growth and yield indicators 6. Soil Nitrogen and Its Management • N transformation in soil • Effects of mineralization and immobilization of N on plants • N management in cropland to increase soil and crop productivity 7. Soil Phosphorus and Its Management • P cycle in soil and atmosphere • P-sorption reactions and their effect on P availability in the soil • P management on farmland to reduce P-sorption in soil

	8. Soil Potassium and Its Management • K forms and their processes of formation in the soil • Factors affecting K availability in soil. • Management of K in cropland to increase soil and crop productivity 9. Soil-Ca, Mg, and S and its management • The cycle of S, Ca, and Mg in the soil and atmosphere • S, Ca, and Mg forms and their reactions in the soil • Factors affecting the availability of S, Ca, and Mg in the soil • Management of S, Ca and Mg in cropland to increase soil and crop productivity 10. Soil Organic Material and Its Management • Definition and properties of organic matter • The process of decomposition of organic matter • The function of organic matter in the soil • Measurement of Soil Organic Matter content • Effects of organic matter on global climate 11. Evaluation and Assessment of Soil Fertility • Techniques for assessing nutrient status in soil • Crop test in laboratory and at the field • Biological Test • Soil test in laboratory and at the field 12. Soil Health and Quality • Indicators of soil quality and health and how to assess them • Factors controlling soil quality • How to assess soil quality and health in the field • Impact of agricultural practices on soil quality and productivity 13. Analysis of Measurement Data of Soil Quality and Health • Practice assessing soil fertility, quality, and health in the field • Analysis of soil quality indicators in the laboratory • Analyzing soil test results in the laboratory • Calculating the soil quality index using the scoring function method • Interpretation of the results of soil quality calculations 14. Recommendations to improve fertility, health, and soil quality based on the calculation of soil quality index • Review journals on soil fertility, soil quality and health to prepare recommendations for the results of data analysis • Group presentation of journal review results and results of soil quality measurements in the field
Test Terms and Forms	Examination requirements: A minimum of 75 % attendance to attend the final exam Forms of examination: Essay
Learning Media	Projector and screen, Zoom application, Google Classroom, e-book, WA Group, Practical guide book, agricultural land for research-based learning
References	Main References : 1. Nurhidayati. 2017. Kesuburan dan Kesehatan Tanah : Suatu Pengantar Penilaian Kualitas Tanah Menuju Pertanian Berkelanjutan. Instrans Publishing. Malang. 2. Havlin, J.L,J.D.Beaton, A.L.Tisdale and W.L. Nelson. 2005. *Soil Fertility and Fertilizers*. 7th edition. Pearson Prentice Hall.

	Upper Saddle River, New Jersey. 3. Karlen, D.L., J.C. Gardner, and M.J.Rosek. 1998. *A Soil Quality Framework For Evaluating The Impact of CRP*. J.Prod. Agric. 11 : 56-60 4. Lal, R. 1998. *Soil Quality and Agricultural Sustainability*. Ann Arbor Press. Chelsea-USA Supporting References : 1. Harris, R.F., D.L. Karlen, and D.J. Mulla. 1996 A Conceptual Framework for Assesment and management of Soil Quality and health, in Methods for Assesing Soil Quality. J.W. Doran and A.J. Jones, Eds. Soil Science Society of America, Madison, WI. 2. Lal, R. 1998. *Soil Quality and Agricultural Sustainability*. Ann Arbor Press. Chelsea-USA 3. Larson, W.E and F.J. Pierce. 1993. *Conservation and Enhancement of Soil Quality*, in Evaluation for Sustainable Land Management in The Developing World. Vol. 2. IBSRAM. 4. Larson,W.E., and F.J. Pierce. 1994. *The Dynamic of Soil Quality as A Measure of Sustainable Management*. P.37 – 51. In J.W. Doran, et al., Defining Soil Quality for A Sustainable Environment. SSSA. Spec. Publ. 35 35. SSSA and ASA.Madison, WI. 5. Mausbach, M.J. and C.A. Seybold. 1998. *Assesment of Soil Quality*. In Soil Quality and Agricultural Sustainability. Ann arbor Press. Chelsea-USA. 6. Nusser, S.M. and J.J. Goebel. 1996. The National Resources Inventory : A Long-Term Multi-Resource Monitoring Program. Environ.Ecol.Stat 7. Oldeman, L.R. 1994. *The Global Extent of Soil Degradation*, in D.J. Greenland and Szabolcs, Eds, Soil Resilience and Sustainable Land Use, CAB International, Wallingford, U.K. P. 99 -118. 8. Plaster, E.J. 2003. *Soil Science & Management* .Thomson Delmar Learning. Australia.