

COURSE TITLE: ADVANCE BOTANY-VIII (SALINITY & WATER LOGGING)

CREDIT HOURS: 3

Syllabus Outline: Importance and Assessment of Salinity and Water Logging, their Impacts on Environment and Ecosystem and Adaptations exhibited by plants.

Course Outline:

SALINITY: Origin of Saline and Sodic Soils; Measurement of Salinity and Sodidity; Classification of Saline and Sodic Soils; Inter-Relations of Water Logging and Salinity, Effects of Soil Salinity and Alkalinity on Plant Growth (a) Osmotic Effect, (b) Specific Ion Effect, (c) Nutritional Imbalance. Quality of Irrigation Water;

Classification of Irrigation Water from view point of its Quality, Management and Reclamation of Saline and Sodic Soils, Mechanism of Salt Tolerance, Methods of Increasing Salt Tolerance in Plants, Biotic Approach and Genetic Engineering for Improvement of Salt Tolerance in Crops, Extent of Salinity in Pakistan.

WATER LOGGING: Origin of Water Logging, Physical and Chemical changes in Soil as a result of Water Logging, Measurement of Soil Redox Potential, Iron and Manganese Relations in Water Logged Soils, Higher Plants and the Water Logged Soils, Adaptations of Plants to Water Logging, Mechanism of Water Logging Tolerance in Plants, Extent of Water Logging in Pakistan.

Module Aims: To make the students well aware of this National Menace and the Ways to Control it.

Learning Strategies:

1. Lectures
2. Group Discussion
3. Laboratory Work
4. Seminar/ Workshop

Learning Outcome: The student should be able to determine when the Soil becomes Water Logged and ultimately Saline and to ways to Manage these National Problems.

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Books Recommended:

1. Horneck, D.A., Ellsworth, J.W., Hopkins, E.G., Sullivan, D.M. and Stevens, R.G. (2007). **Managing Salt affected Soils for Crop Production. Oregon State University.**
2. Hoorn, W.V. and Alpen J.G. (2006). Salinity Control in Retzema. (Ed.) Drainage Principle and Applications. Pub. No. 16. International Institute for Land Reclamation and improvement (LRRI). Wageningen, Netherland.

3. Warsi, I. (2005).. Master Plan of Pakistan, Main Report Volume II. IWRPO.
4. World Bank, (2005). Pakistan Water Resources Assessment Strategy, Report No. 34081PK. Agricultural & Rural Development Unit South Asia Region Washington D.C.
5. Shah, A.H., Anwar-ul-Haq and Bhutta, M.N. (2003). Success of Biosaline Approach for Land Rehabilitation. Pakistan Community Project for Rehabilitation of Saline and Water Logged land, WARSI Report No. 2003/22.
6. Qurashi, R.U. and Lennard, E.G.B. (1999). A Hand Book of Saline Agriculture of Irrigated lands in Pakistan. Australian Centre for International Agriculture Research.
7. Warsi, I. (UNDP) (1992). Manual of Salinity Research Methods. Warsi Publication No. 147, Lahore.
8. Alien, S.E. (1976). Chemical Analysis of Ecological Material. Blackwell Scientific Publications.
9. Mayber, P. and Gale, G. (1975). Plants in Saline Environment. Springer Verlag, Berlin, Washington.

TITLE: ADVANCEBOTANY-LAB-VIII (SALINITY AND WATER LOGGING)

CREDIT HOURS: 1

Syllabus Outline: Various Physical and Chemical Parameters to Assess Salinity, observations of hazardous Impacts of Water Logging and Salinity of Plants. Course Outline:

1. Measurement of Electrical Conductivity of Soil Saturation Extract.
2. Measurement of Cation Exchange Capacity of Soil.
3. Determination of the Amounts of Soluble Calcium.
4. Calculation of Exchangeable Sodium Percentage of Soil from its Sodium Adsorption Ratio.
5. Determination of the Amounts of Chlorides and Sulphates in a Soil Saturation Extract.
6. Analysis of Irrigation Water for the following: Electrical Conductivity, Sodium Adsorption Ratio, Chlorides, Sulphates, Carbonates, Bicarbonates, Total Dissolved Salts, Nitrates, Fluorides, Iron and Silica.
7. Classification of Irrigation Water from the view point of its Salinity and Sodium Hazard.
8. Effects of Salinized Media on Germination of Seeds of Different Crop Plants.
9. Experimental Investigation to test the Salt Tolerance of Different Crop Plants.
10. Quantitative studies of Halophytes in the Field.
11. Measurement of pH and EC of a Water Logged Soil.
12. Measurement of the amount of Iron and Manganese in Water Logged Soils.
13. Field observations on Water Logging of Soil and its Effects on Plant Distribution through Quantitative Studies of Vegetation.
14. Visit to WASID Laboratories of WAPDA and Laboratories of Land Reclamation Directorate, Lahore.
15. Field Tours to Saline and Water Logged Areas of Punjab.

Module Aims: The student is expected to make a complete Analysis of Saline Sodic and Water Logging and suggest Ways of Reclamation and Remediation.

Learning Strategies:

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Learning Outcome: The students should be able to assess Salinity and Water Logging in the Field and their Hazardous Impacts on Plants. i

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Books Recommended:

1. F.A.O. (1994). The Literature of Soil Science. Bulletin No. 59, Irrigation and Drainage Series.
2. Horneek, D.A., EUsworth, J.W., Hopkins, B.G., Sullivan, D.M. and Stevens, R.G. (2007). Managing Salt Affected Soils for Crop Production. Oregon Star University.
3. Hoorn, W.V. and Alpen J.G. (2006). Salinity Control. In; Retzema (ed.) Drainage Principle and Applications. Pub. No. 16. International Institute for Land Reclamation and improvement (LRRI). Wageningen, Netherland.
4. IWARSI, I (2005). Master Plan of Pakistan. Main Report, Volume II. IWRPO.
5. Armstrong, W. (2005). Water Logged Soils. In; Environment and Plant Ecology (Etherington, J.R.) John Wiley and Sons, Inc. New York.
6. World Bank, (2005). Pakistan Water Resources Assessment Strategy, Report No. 34081PK. Agricultural and Rural Development Unit South Asia Region Washington D.C.
7. Shah, A.H., Anwar-ul-Haq and Bhutta, M.N. (2003). Success of Biosaline approach for land Rehabilitation. Pakistan Community Project for Rehabilitation of Saline and Water Logged Land, Warsi, Report No. 2003/22.
8. Chapman, V.J. (2001). Salt Marshes and Salt Deserts of the world. (Net Prescribed).
9. Qurashi, R.U. and Lennard, E.G.B. (1999). A Hand Book of Saline Agriculture of Irrigated Lands in Pakistan. Australian Centre for International Agriculture Research.
10. Warsi I. (UNDP) (1992). Manual of Salinity Research Methods. Warsi Publication No. 147, Lahore.
11. Alien, S.E. (1976). Chemical Analysis of Ecological Material. Blackwell Scientific Publications.
12. Mayber, P. and Gale, G. (1975). Plants in Saline Environment. Springer VerSiag, Berlin, Washington.
13. UNESCO (1973). Irrigation, Drainage and Salinity.
14. Waisel Y. (1972). Biology of Halophytes. Tel Aviv University Press.