The graduate programs of the Department of Soil and Crop Sciences are designed to prepare individuals for careers in research, teaching, extension and industry, and management of agronomic enterprises. Agronomy, food science and technology, genetics, molecular and environmental plant sciences, plant breeding, soil science, and water management and hydrological science are majors available to students.

Research-oriented programs in agronomy, food science and technology, genetics, plant breeding, molecular and environmental plant sciences, soil science, and water management and hydrological science lead to the MS or PhD degree in these fields. There is no language requirement at the MS or PhD level. Members of the faculty have expertise in cereal chemistry, crop breeding, crop physiology, environmental agronomy, cytogenetics, plant physiology, protein chemistry, environmental soil science, soil chemistry, soil fertility, soil genesis and classification, soil microbiology, soil mineralogy, soil physics, soil-plant-water relations, turfgrass science, weed science and water microbiology. Recipients of the MS and PhD degrees may obtain a research-, teaching-industry- or extension-oriented position upon graduation.

Multidisciplinary programs can be arranged with other academic departments in the University.

### Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Institution</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aitkenhead, Jacqueline A</td>
<td>Associate Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>University of New Hampshire, 2000</td>
<td>2000</td>
</tr>
<tr>
<td>Awika, Joseph M</td>
<td>Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>Texas A&amp;M University, 2003</td>
<td>2003</td>
</tr>
<tr>
<td>Bagavathiannan, Muthukumar V</td>
<td>Assistant Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>University of Manitoba, Canada, 2010</td>
<td>2010</td>
</tr>
<tr>
<td>Baltensperger, David D</td>
<td>Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>New Mexico State University, 1981</td>
<td>1981</td>
</tr>
<tr>
<td>Crallle, Harry T</td>
<td>Associate Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>University of Minnesota, Twin Cities, 1979</td>
<td>1979</td>
</tr>
<tr>
<td>Deng, Youjun</td>
<td>Associate Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>Texas A&amp;M University, 2001</td>
<td>2001</td>
</tr>
<tr>
<td>Finlayson, Scott A</td>
<td>Associate Professor</td>
<td>Soil &amp; Crop Sciences</td>
<td>University of Calgary, 1994</td>
<td>1994</td>
</tr>
</tbody>
</table>
Courses

SCSC 603 Cytological and Histological Principles in Plant Breeding
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Modern concepts and recent developments for advanced students in plant and soil sciences and related fields employing microscopic evaluation; specimen preparation, stain technology, theory and use of microscopes, micromanipulators, microtomes, the microtome cryostat, use of equipment in modern cytological research.
Prerequisite: Graduate classification.

SCSC 605 Pedology
Credits 3. 3 Lecture Hours.
Soil genesis, morphology and classification; development of a working knowledge of soil taxonomy and diagnostic horizons used in placement of soils.
Prerequisites: SCSC 301 or equivalent; or approval of instructor. Two 2-day field trips for which departmental fees may be assessed to cover costs.

SCSC 607 Crop Physiology
Credits 3. 3 Lecture Hours.
Growth and productivity of major agronomic crops as related to plant physiological processes and environmental parameters, including manipulation of crop growth for enhanced production.
Prerequisites: SCSC 303; MEPS 313.

SCSC 609 Integrated Farming Systems
Credits 3. 3 Lecture Hours.
System-oriented course that stimulates critical thinking and debate regarding the strength and weakness of modern crop and livestock production systems within the context of ecological and economic sustainability; evaluates conservation tillage, integrated nutrient and pest management and multiple cropping systems.
Prerequisite: Approval of instructor.

SCSC 610 Host Plant Resistance
Credits 3. 3 Lecture Hours.
Host plant resistance programs from the standpoint of the plant breeder, plant pathologist and entomologist; team taught with each discipline represented; roundtable discussion of assigned readings and lectures.
Prerequisite: Approval of instructor.
Cross Listing: ENTO 610 and PLPA 610.

SCSC 611 Introduction to Environmental Biophysics
Credits 4. 3 Lecture Hours. 2 Lab Hours.
Theoretical and experimental analysis of interactions between living organisms and their environments; measurement and modeling of the physical environment; measurement and modeling of energy and mass transfer between organisms and their environments, and of organism response to fluxes of mass and energy.
Prerequisites: Graduate classification and approval of instructor.

SCSC 613 Ethical Aspects of International Agricultural Systems
Credits 3. 3 Lecture Hours. 0 Lab Hours.
Diverse theories of morality; ethical dimensions of population growth, high yielding crop production systems, genetic engineering, and use of land, soil, and water.
Prerequisites: Approval of instructor.
SCSC 615 Reclamation of Drastically Disturbed Lands  
Credits 3. 3 Lecture Hours.
Theoretical and practical aspects of reclamation of lands disturbed during mining of lignite, uranium, phosphorous, oil shale and other minerals and disturbances due to industrial activities; emphasis on physical and chemical characteristics of disturbed materials and their impact on establishment of permanent vegetation.  
Prerequisite: SCSC 301 or approval of instructor.

SCSC 618 Analysis of Environmental Systems  
Credits 2. 1 Lecture Hour. 2 Lab Hours.
Classical and contemporary methods for analyzing chemical components of environmental systems, soil, water, plants and gases; environmental chemistry coupled with experiential.  
Prerequisite: Graduate classification.

SCSC 619 Molecular Methods for Microbial Characterization  
Credits 3. 2 Lecture Hours. 2 Lab Hours.
Underlying principles of molecular methods for microbial detection and characterization in natural and man-made ecosystems; emphasis on method application and data interpretation; emphasis on microbial pathogens and indicator organisms in foods and environment; laboratory covers select protocols.  
Prerequisites: SCSC 405; FSTC 326/DASC 326; POSC 429; approval of instructor.  
Cross Listing: FSTC 619, POSC 619, VTMI 619.

SCSC 620 Brazilian Agriculture and Food Production Systems  
Credits 3. 3 Lecture Hours.
Compare Brazilian and U.S. agriculture and culture related to soil, water, and forest conservation and management in Brazil; tour and learn about Amazon River, rain forest, Brasilia, farm, ranch, and floral production systems, agricultural cooperatives and research, sugar and alcohol production, phosphate mining and production; visit points of interest.  
Prerequisite: Approval of instructor.

SCSC 621 International Agricultural Research Centers - MX  
Credits 3. 3 Lecture Hours.
Introduction to international agricultural research, Consultative Group on International Agriculture activity; modern and underdeveloped tropical agricultural systems; introduction to Mexican culture; critical evaluation of complex and international agricultural issues and research programs.  
Prerequisite: Approval of instructor; graduate classification.

SCSC 623 Natural Resources and Agricultural Sustainability in UK  
Credits 3. 3 Lecture Hours.
Environmental impacts and sustainability of United Kingdom and U.S. agriculture compared; soil, water, crop, and environmental management; conservation of watersheds; production of hydropower; sustainable use of water resources; cultural immersion.  
Prerequisite: Approval of instructor.

SCSC 624 Soil Chemistry  
Credits 3. 3 Lecture Hours.
Chemistry of clay minerals, inorganic solid phases, and organic colloids in soil; mass transfer reactions in soils: absorption/desorption, precipitation/dissolution, gas/liquid phase exchange; principles of soil acidity and salinity; introduction to application of equilibrium concepts in soils.  
Prerequisites: SCSC 301 or approval of instructor.

SCSC 625 Biofuels and the Environment  
Credits 2. 2 Lecture Hours.
Biofuel crop use and disposal; production systems; conversion technologies; impacts of bioenergy production on sustainability, environment, and soil and water quality; carbon and energy budgets.  
Prerequisite: SCSC 301 or approval of instructor.

SCSC 626 Soil Mineralogy  
Credits 3. 3 Lecture Hours.
Crystal structures and properties of important minerals in soils and sediments especially clay minerals and oxides combined with identification techniques involving theory and practice with x-ray diffraction, electron microscopy, infrared and chemical methods.

SCSC 627 Soil Chemistry and Fertility  
Credits 3. 3 Lecture Hours.
Chemical and biological behavior of nitrogen, phosphorus and potassium in soils; secondary nutrients, micronutrients and soil acidity and liming; interpretation of soil chemical/biochemical research from historical and current literature and relationships with nutrient availability, plant uptake, and environmental quality.  
Prerequisites: SCSC 422; MEPS 313.

SCSC 628 Soil Mineralogy Lab  
Credits 2. 4 Lab Hours.
Mineral identification and quantification techniques involving theory and practice with x-ray diffraction, electron microscopy (SEM and TEM). Fourier transform infrared spectroscopy and chemical methods.  
Prerequisite: SCSC 626.

SCSC 629/VTMI 629 Laboratory Quality Systems  
Credits 3. 3 Lecture Hours.
Quality systems and method development used within a laboratory; ensuring the integrity of procedures used in lab processes, chain of custody, information management, and international laboratory standards; regulatory requirements for laboratory operation; bio-security precautions; laboratory management.  
Cross Listing: VTI 629/SCSC 629.

SCSC 630/FSTC 630 Cereal Grains for Human Food  
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Fundamental concepts of dry milling, wet milling, oil extraction, baking, malting, brewing, storage, sanitation, and quality evaluation and control interrelated with physical and biochemical properties of cereals and their products; use of instruments and techniques to evaluate cereal quality.  
Prerequisite: Approval of instructor.  
Cross Listing: FSTC 630/SCSC 630.

SCSC 631 Prerequisite Programs for Feed Industry HACCP  
Credit 1. 1 Lecture Hour.
Development of preliminary science-based risk management decision factors in feed industry; understanding and complying with FDA regulatory requirements for animal feed; application of international standards; essential programs for Feed Industry Hazard Analysis and Critical Control Point (HACCP); module one of three.  
Prerequisite: Graduate classification.

SCSC 632 Feed Industry HACCP - Principles and Plan Development  
Credit 1. 1 Lecture Hour.
Principles of Feed Industry Hazard Analysis and Critical Control Point (HACCP) plan development; science-based risk analysis of decision factors; regulatory requirements of HACCP; module two of three.  
Prerequisite: SCSC 631.
SCSC 633 Feed Industry HACCP - Advanced Plan Development 
Credit 1. 1 Lecture Hour.
Principles of Feed Industry Hazard Analysis and Critical Control Point (HACCP) advanced plan development; case studies of HACCP principles; HACCP plan development for feed industry companies; module three of three.
Prerequisites: SCSC 631 and SCSC 632.

SCSC 634 Regulatory Science Principles 
Credits 3. 3 Lecture Hours.
Regulatory tools, standards and practices to improve the protection and compliance of regulated systems; interdependence of regulatory agencies; models of risk analysis with emphasis on conducting a qualitative and quantitative risk assessment; and implications of compliance.

SCSC 635/AGEC 639 Comparative Global Standards in Food Systems 
Credits 3. 3 Lecture Hours.
Laws, regulations and standards governing the production, distribution, processing and marketing of food across regions of the world; international standard setting bodies and risk assessment committees; regulatory equivalency and harmonization; product approval procedures; cost/benefits of global standards and trade agreements.
Cross Listing: AGEC 639/SCSC 635.

SCSC 636 Regulatory Science: Methodology in Food Systems 
Credits 3. 3 Lecture Hours.
Risk management methodology including investigation of food and feed firms, conducting internal compliance audits; sample collection, chain-of-custody, trace-back and trace-forward, recalls, label review, data interpretation, risk ranking, resource prioritization, incident command and rapid response.
Prerequisite: SCSC 634.

SCSC 637 Environmental Microbiology 
Credits 3. 3 Lecture Hours.
Microbial diversity and interactions in various environments with emphasis on soil and freshwater systems. Molecular methods for detection and characterization of indigenous and introduced microorganisms. Environmental sources and fate of pathogens. Biotechnological applications of environmental microorganisms.

SCSC 639 Physiological Basis of Crop Improvement 
Credits 3. 3 Lecture Hours.
The underlying physiological basis of past, current and future crop improvement including the associated molecular mechanisms; traits considered include root and shoot architecture, radiation to use efficiency, flowering time, floral development and sex, high density planting tolerance, stress tolerance, crop-microbe interactions and yield.
Prerequisites: SCSC 307 or approval of instructor.

SCSC 640 Intellectual Property in the Plant Sciences 
Credits 3. 3 Lecture Hours.
Introduction to major foci of intellectual property (IP) impacting plant sciences, including: 1) traditional vs. emerging knowledge economies, 2) governing statutes and treaties, 3) forms of IP, and 4) IP asset identification, valuation, capture and deployment towards understanding the best practices for IP strategy development and IP portfolio management.

SCSC 641 Plant Breeding I 
Credits 3. 3 Lecture Hours.
Theoretical and practical aspects of plant breeding including genetic basis; application of breeding methods and interdisciplinary considerations in breeding problems.
Prerequisites: SCSC 304 or HORT 404/GENE 404; GENE 301; STAT 651.

SCSC 642 Plant Breeding II 
Credits 3. 3 Lecture Hours.
Expectations of genetic improvement for different plant breeding methods; relative efficiency for crops of different reproductive mechanisms; genetic variances, covariances and genotype-environment interaction components of variance used in planning selection procedures.
Prerequisites: SCSC 641; GENE 613; STAT 619.

SCSC 643/GENE 643 Molecular Quantitative Genetics and Plant Breeding 
Credits 3. 3 Lecture Hours.
Classical, applied and molecular aspects of quantitative genetics in plant breeding; genetic relationships; genetic diversity; genetic phenomena (linkage, heterosis and epistasis); genotype by environment interaction; mapping quantitative trait loci (QTL); genomic and marker-assisted selection; application of statistical software.
Prerequisites: STAT 651, SCSC 642 or GENE 613; or approval of instructor.
Cross Listing: GENE 643/SCSC 643.

SCSC 644 Forage Ecology and Management 
Credits 3. 3 Lecture Hours.
Investigation of multidisciplinary approaches toward the development of integrated forage, livestock, and wildlife production systems that are economically feasible and environmentally sustainable.
Prerequisites: Approval of instructor and graduate classification.

SCSC 645/HORT 645 World Agriculture and International Plant Breeding 
Credit 1. 1 Lecture Hour.
Evolution of world agriculture; plant breeding and improved varieties; international agricultural research centers and green revolution; population growth; environmental challenges; IPR; role of plant breeding and biotechnology in meeting world food needs.
Prerequisite: SCSC 304, HORT 404/GENE 404 or approval of instructor.
Cross Listing: HORT 645/SCSC 645.

SCSC 646 Advanced Studies in Cotton Fiber Quality and Its Measurements 
Credits 3. 3 Lecture Hours.
Advanced studies in cotton fiber quality and its measurement will explore the morphology of cotton fiber growth, the instruments used to determine fiber quality, and the interpretation of quality measurements.

SCSC 650 Mode of Action and Environmental Fate of Herbicides 
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Relationships between physical-chemical characteristics of herbicides and their biological activity, selectivity, environmental fate in soil, water, and plants. Laboratory includes practical applications of gas and liquid chromatography, liquid scintillation counting and plant bioassays.
Prerequisite: SCSC 450 or approval of instructor.

SCSC 651 Weed Biology and Ecology 
Credits 3. 2 Lecture Hours. 2 Lab Hours.
Fundamentals of weed invasion, development, persistence and competition with agronomic crops; consideration of ecological concepts important to weed-crop relationships as influenced by weed control and other cultural practices. Practical consideration of integrated weed management systems and weed identification.
Prerequisites: SCSC 303; MEPS 313.
SCSC 653 Essentials for Weed Systematic Identification and Management in Agronomy  
Credits 3. 3 Lecture Hours.  
Fundamental understanding and hands-on training on the basics of plant weed identification and management; relevant to agronomy, turf, horticulture and rangeland science and vegetation identification and management.

SCSC 654 Analysis of Complex Genomes  
Credits 3. 3 Lecture Hours.  
History and current status of genetic and molecular analysis of higher eukaryotic genomes; coverage of techniques for dissection of genomes into manageable parts; investigations in genetics, breeding and evolution; emphasis on quantitative inheritance, genetic mapping, physical mapping, map-based cloning, with examples drawn from a wide range of organisms.  
Prerequisite: GENE 603 or GENE 431/BICH 431.  
Cross Listing: GENE 654 and MEPS 654.

SCSC 655 Analysis of Complex Genomes--Lab  
Credits 3. 0 Lecture Hours. 7 Lab Hours.  
Laboratory methods in molecular genetic techniques for genetic mapping, physical mapping, and map-based cloning of both qualitative and quantitative phenotypes.  
Prerequisite: GENE 603 or equivalent or approval of instructor.  
Cross Listing: GENE 655 and MEPS 655.

SCSC 657 Environmental Soil and Water Science  
Credits 3. 3 Lecture Hours.  
Discussion of physical, chemical, and biological properties of soil and water and the impact on productivity and sustainability of various ecosystems; application of the knowledge of properties and soil processes to develop and evaluate strategies for protecting and/or improving soil and water quality.  
Prerequisite: SCSC 301. Stacked with SCSC 455.

SCSC 658 Watershed and Water Quality Management  
Credits 3. 3 Lecture Hours.  
Land use impact on surface and ground water chemistry; legislation impacting water quality; surface and groundwater impairment and restoration; case studies in best management practices.  
Prerequisite: Graduate classification.

SCSC 660 Experimental Designs in Agriculture  
Credits 3. 3 Lecture Hours.  
Fundamental principles and procedures of experimental designs in agricultural sciences; emphasis includes factorial designs, predicting outputs, use of covariance, balanced and unbalanced experimental designs as related to common agricultural research projects under field, greenhouse or growth chamber culture; familiarization with computer programming of common statistical software.  
Prerequisite: STAT 651.

SCSC 663/ESSM 663 Applied Spatial Statistics  
Credits 4. 3 Lecture Hours. 2 Lab Hours.  
An introduction to the theory and practice of spatial statistics as applied to the natural resources. Spatial analyses focusing primarily on ordinary kriging, point processes, and lattice data.  
Prerequisites: MATH 141, MATH 142, STAT 651, or equivalents; ESSM 651 preferred.  
Cross Listing: ESSM 663/SCSC 663.

SCSC 671/MEPS 671 Plant Growth and Development  
Credits 3. 3 Lecture Hours.  
Comprehensive analysis of plant development primarily focused on the molecular and cellular processes underlying morphogenesis, vegetative growth and reproduction; role of the major phytohormones as coordinators of development will be analyzed; plastic developmental responses to conditioning environmental signals.  
Prerequisites: MEPS 601 or approval of instructor.  
Cross Listing: MEPS 671/SCSC 671.

SCSC 681 Seminar  
Credit 1. 1 Lecture Hour.  
For graduate students and staff members in soils and crops; presentation and discussion of special topics and research data; participation required of all graduate students in agronomy.

SCSC 684 Professional Internship  
Credits 1 to 16. 1 to 16 Lecture Hours.  
Program planned to provide professional training in student’s particular field of interest. Faculty and employer will supervise the activity.  
Prerequisite: Approval of instructor.

SCSC 685 Directed Studies  
Credits 1 to 4. 1 to 4 Lecture Hours.  
Advanced problems in some phase of agronomy not directly related to thesis or dissertation.

SCSC 689 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.  
Selected topics in an identified area of agronomy. May be repeated for credit.  
Prerequisite: Approval of department head.

SCSC 691 Research  
Credits 1 to 23. 1 to 23 Other Hours.  
Investigations leading to thesis or dissertation.