

# Crop Science (CS)

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## **CS 101 Field Crop and Turfgrass Management Orientation** (1 credit hours)

Introduction to NCSU and the Agricultural Institute with an emphasis on areas related to Field Crops Technology and Turfgrass Management. Students will explore university, college, and departmental resources, academic policies and procedures, career opportunities, and current trends and issues in our related disciplines. Students cannot receive credit for both CS 10 and AGI 10. FCT or TGM only.

Requisite: Agricultural Institute Only  
Typically offered in Fall only

## **CS 111 Field Crop Production** (4 credit hours)

Management of field crops, including growth and development, establishment, pest management, environmental considerations, rotations of crops and chemicals, harvesting, storage and marketing. SPEARS

Requisite: Agricultural Institute Only  
Typically offered in Fall and Spring

## **CS 116 Agronomic Crops - Cotton, Peanuts, and Tobacco** (3 credit hours)

Fundamental agronomic practices associated with the production of cotton, peanuts, and tobacco. Discussions will include crop growth and development stages, how to choose the best varieties and hybrids, planting strategies, fertility and pest management programs, harvest and storage options, and the use of technologies associated with the production and maintenance of a quality commodity.

Restriction: AGI Only  
Typically offered in Fall only

## **CS 118 Agronomic Crops - Corn, Small Grains and Soybeans** (3 credit hours)

Fundamental agronomic practices associated with the production of corn, small grains and soybean. Discussions will include crop growth and development stages, how to choose the best varieties and hybrids, planting strategies, fertility and pest management programs, harvest and storage options, and the use of technologies associated with the production and maintenance of a quality commodity.

Restriction: AGI Only  
Typically offered in Spring only

## **CS 121 Turfgrasses and Their Uses** (3 credit hours)

An introduction to turfgrass species and their uses. Emphasis on: size and scope of the turfgrass industry, basic concepts of grass growth and development, characteristics of cool- and warm-season turfgrasses and their use for golf courses, lawns, athletic fields, and other applications. Techniques for successful establishment and maintenance of turfgrass areas.

Requisite: Agricultural Institute Only  
Typically offered in Fall only

## **CS 122 Principles of Turfgrass Management** (3 credit hours)

An examination of cultural practices essential for management of high quality turfgrass areas. Topics include: function of plant nutrients, fertilizer characteristics and application techniques, irrigation programming, construction of high use turfgrass areas, calibration of spreaders and sprayers, aerification, pesticide fate and developing effective management systems. ERICKSON

Requisite: Agricultural Institute Only  
Typically offered in Spring only

## **CS 151 Forage Production** (3 credit hours)

Characteristics of major forage crops and their response to agronomic and animal management factors. Utilization methods, growth and quality characteristics related to animal performance. GREEN

Requisite: Agricultural Institute Only  
Typically offered in Spring only

## **CS 152 Weed Control in Field Crops** (3 credit hours)

Principles involved in development of weed control programs and practical application of weed management techniques for major North Carolina cropping systems. Emphasis on proper use of herbicides. Laboratory includes weed identification and herbicide application methods. JORDAN

Requisite: Agricultural Institute Only  
Typically offered in Fall only

## **CS 154/PP 154 Turf Weed and Disease Management** (3 credit hours)

General principles in turfgrass weed and disease development and management programs. Different weeds, their life cycles, management techniques, and factors affecting herbicide application performance will be covered. Students will learn the causes, development, identification and management of turfgrass diseases. Laboratory includes weed identification and herbicide application methods. Certain laboratory exercises will require personal transportation to Lake Wheeler Road Turf Field Lab unless otherwise specified by the lab instructors. The course is restricted to AGI students only.

Requisite: Agricultural Institute Only  
Typically offered in Fall only

## **CS 155 Advanced Turf Management** (3 credit hours)

Turfgrass management covering mineral nutrition, water relations, environmental stress responses and management regimes for low maintenance turf, golf courses, athletic fields and other turf settings.

Requisite: Agricultural Institute Only; Prerequisite: CS 121 and CS 122  
Typically offered in Spring only

## **CS 190 Turf Seminar** (1 credit hours)

Discussions of the operations, opportunities, and problems existing in various phases of the turf industry by leaders in the various facets of the industry.

Requisite: Agricultural Institute Only  
Typically offered in Spring only

**CS 191 Field Crops Seminar** (2 credit hours)

Guest speakers, students presentations, and outside assignments will address professionalism; professional development; and current challenges, issues, and opportunities facing profitable and sustainable agronomic crop production. A grade of C or better is required. FCT Only.

Requisite: Agricultural Institute Only

*Typically offered in Spring only*

**CS 200 Introduction to Turfgrass Management** (4 credit hours)

Turfgrass selection, establishment, maintenance, and pest management in lawns, golf courses, athletic fields, and roadside care; Emphasis on understanding the impact of the environment on management practices and turfgrass performance. Field trips in laboratory.

Prerequisite: BIO 181(preferred) or ZO 160(alternate) BO 200, or CS 213

*Typically offered in Fall only*

**CS 210 Lawns and Sports Turf** (3 credit hours)

Utilization of turfgrasses for lawns and recreational areas. Emphasis on: the cultural and environmental benefits of grassed areas, concepts of grass growth and development, selecting adapted grasses for proper use, techniques for successful establishment and management of cool-and-warm-season turfgrasses, fertilization, irrigation, aeration, and pest management. The history and benefit of natural and artificial sports fields will also be discussed. Credit will not be awarded for both CS 200 and CS 210.

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

**CS 211 Plant Genetics** (3 credit hours)

Fundamentals of plant genetics. Genetic basis for plant improvement. Genetic analysis of Mendelian traits, molecular structure and organization of genetic material, crop biotechnology, distribution and behavior of genes in populations.

Prerequisite: BIO 183 or ZO 160

*Typically offered in Spring only*

**CS 213 Crop Science** (3 credit hours)

Our basic premise is that to produce field crops successfully we must know how our crops grow and develop and what they require from the production environment - including the farmer - for satisfactory management of the relevant environment, and finally to successful yield and quality of commercially important product. Especially important is to understand the various ways in which producers must respond to ever-changing circumstances on the farm, at the bank (credit), and in the marketplace. A solid understanding of the impact of cropping history on the soil and entire ecosystem to be used for the next crop also is vitally important.

Prerequisite: BIO 105 or BIO 181 or BIO 183 or PB 200 or PB 250

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

**CS 214 Crop Science Laboratory** (1 credit hours)

The laboratory's intent is to provide students enrolled in the CS 213 lecture course opportunity to apply under field and controlled environmental conditions the crop production principles introduced in the lecture course. Using a hands-on approach targeting a variety of crop management approaches, students will examine the growth and development characteristics that relate most directly to final yield and quality of the marketed product. Students will employ a spectrum of treatment combinations aimed at strengthening understanding of the interaction of genotype, environment, and management, with the goal of identifying influential factors of crop yield and quality.

Prerequisite: BIO 181 or BIO 183 or PB 200 or PB 250; Co-requisite: CS 213

*Typically offered in Fall and Spring*

**CS 216 Southern Row Crop Production - Cotton, Peanuts, and Tobacco** (3 credit hours)

Crop production systems comprised of cotton, peanuts, and tobacco are unique to the southern United States, and management practices tailored to a successful harvest are vastly different than those employed in the production of grain crops. CS 216 will introduce students to these production standards and provide a basic foundation for the principles of cotton, peanut, and tobacco management. At the conclusion of the course students will be able to describe growth/development patterns, tillage systems, scouting techniques, proper seed/variety selection and planting populations, provide recommendations for pest management, employ Integrated Pest Management strategies, describe harvesting practices, and give marketing approaches for each crop.

*Typically offered in Fall and Spring*

**CS 218 Southern Row Crop Production - Corn, Small Grains and Soybeans** (3 credit hours)

Fundamental agronomic practices associated with the production of corn, small grains and soybean. Discussions will include crop growth and development stages, how to choose the best varieties and hybrids, planting strategies, fertility and pest management programs, harvest and storage options, and the use of technologies associated with the production and maintenance of quality commodity.

*Typically offered in Fall and Spring*

**CS 224 Seeds, Biotechnology and Societies** (3 credit hours)

An exploration of seeds, how seeds are the delivery system for crop biotechnology and how a specific culture's perception of science and agriculture influence the acceptance or rejections of modern genetic technologies. Topics include seed germination, survival and preservation; seed industry influence on societies and how societies are influencing the seed industry; seed production - commercially and at home; how our diverse genetic resources are preserved; how biotechnology is applied to agriculture and delivered through seeds; the impact biotech is having on the seed industry and subsequently on us and global agriculture; concerns and potential benefits of biotechnology application to crops.

*GEP Global Knowledge, GEP Interdisciplinary Perspectives*

*Typically offered in Fall, Spring, and Summer*

**CS 230 Introduction to Agroecology** (3 credit hours)

This course will examine the biological and physical attributes of farming systems and their associated ecological and social impacts in temperate and tropical regions. It will address the ecological consequences of indigenous food and fiber production systems, conventional agricultural systems and "alternative" systems that incorporate biological pest control and natural nutrient inputs. Students will examine several case studies that integrate their understanding of concepts.

Prerequisite: BIO 105 or BIO 181 or BIO/ZO 160 or BO 200 or BO 250 or HS 201 or CS 213

*GEP Global Knowledge, GEP Interdisciplinary Perspectives*

*Typically offered in Fall and Spring*

**CS 251 Production of Forage Crops** (3 credit hours)

Basic principles and practices of production and utilization of pasture and forage crops; impact on developing sustainable systems for livestock feed, soil and water conservation; use of computers to assist in whole farm planning and information retrieval.

Prerequisite: CS 213 and SSC 200

*Typically offered in Spring only*

**CS 400 Turf Cultural Systems** (3 credit hours)

Topics include: golf course design considerations, fertilizer characteristics and application techniques, irrigation programming, construction of high use turfgrass areas, calibration of spreaders and sprayers, aerification, pesticide fate and development of effective management systems.

Prerequisite: C- or better in CS 200

*Typically offered in Fall only*

*This course is offered alternate even years*

**CS 410/HS 410 Community Food Systems** (3 credit hours)

This course explores the economic, socio-cultural, policy and health perspectives of community food systems using a multidisciplinary and systems-level framework. Students will use a systems framework to critically examine local and global food challenges related to food insecurity, food justice and food sovereignty, food waste and sustainable approaches to addressing food challenges. Novel aspects of this course include student experiential learning opportunities that include service learning with community partners addressing local food challenges, team building through group work and in-class discussion and development of personal food ethic provocative proposition.

Prerequisite: Junior or senior standing

*Typically offered in Fall only*

**CS 413 Plant Breeding** (3 credit hours)

Focuses on principles of cultivar development for a diversity of plant species using conventional breeding and selection methodologies, DNA markers, de novo genetic variation, and biotechnological approaches.

Prerequisite: CS 211 or GN 311

*Typically offered in Spring only*

**CS 414/CS 514 Weed Science** (4 credit hours)

Introduces topics fundamental to the discipline of weed science. Lecture topics include losses caused by weeds, weed biology, weed ecology, biological, chemical, cultural, and mechanical weed control, herbicide modes of actions, uses, and symptomology, and herbicide resistance. In addition, students will be introduced to weed management in various facets of agriculture through guest lectures from a wide range of NC State faculty with weed management responsibilities. Guest lectures include weed management in traditional row crops, aquatics, turf, tobacco, vegetables, ornamentals, pastures and hay crops, organic systems, and tree fruit.

*Typically offered in Fall only*

**CS 415 Integrated Pest Management** (3 credit hours)

History, principles, and application of techniques for managing plant pests. Theory and practice of integrating pest control tactics to manage pests within economic, environmental, and sociological constraints. Topics include pest monitoring methodology, economic aesthetic thresholds, biological control, efficient pesticide use, biotechnology, and global positioning systems.

Prerequisite: BIO 181(preferred) or ZO 160(alternate) or BO 200 or BO 250

*Typically offered in Spring only*

**CS 418/CS 518 Introduction to Regulatory Science in Agriculture** (3 credit hours)

This course covers laws, regulations and agencies involved in the registration of conventional, biotechnology and biological crops, crop protectants and growth regulators. US and International laws and regulations will be discussed from technical proof of concept through commercial release.

*Typically offered in Fall only*

**CS 424/CS 524 Seed Physiology** (3 credit hours)

This course will explore the physiological processes associated with seed formation, development, maturation, germination, and deterioration of agronomic and horticultural species. We will also study the physiological aspects of seed dormancy, how dormancy is manifested and overcome in cultivated and noncultivated systems and dormancy's impact on weed seedbank ecology.

Prerequisite: PB 321 or PB 421 or FOR 303

*Typically offered in Fall only*

**CS 428/CS 528 Advanced Regulatory Science in Agriculture** (3 credit hours)

This course goes into additional depth and provides hands-on exercises concerning agriculture regulatory topics covered in CS 418/518. The course will introduce laws, regulations and agencies involved in the fertilizer, animal and waste management as well as the role of public policy in the regulatory process. CS 418/518 is a prerequisite for this class.

Prerequisite: CS 418

*Typically offered in Spring only*

**CS 430/CS 530 Advanced Agroecology** (4 credit hours)

This course applies agroecological principles and critical thinking to evaluate various agroecosystems. Students will examine food, fiber, and other commodity production systems for security, productivity, and sustainability and address the simultaneous need to protect natural environments and the biodiversity on which agroecosystems depend. Topics include discussion of national and international government policies, research programs, and education programs that influence the future application of agroecosystem principles.

P: CS 230

*Typically offered in Spring only*

**CS 465/CS 565 Turf Management Systems and Environmental Quality** (3 credit hours)

Integration of turfgrass management systems and the use of BMPs and IPM to protect environmental quality. Examination of water quality issues relative to turf. Application of Best Management Practice and Integrated Pest Management strategies. Credit cannot be received for both CS 465 and CS 565. Senior standing.

Prerequisite: CS 400 and Senior standing

*Typically offered in Fall only*

*This course is offered alternate even years*

**CS 470/ENT 470/PP 470 Advanced Turfgrass Pest Management** (2 credit hours)

Characteristics and ecology of turfgrass weed, insect, and disease pests; identification and diagnosis of turfgrass pests, strategies for managing pests including cultural, mechanical, biological, and chemical methods; development of integrated pestmanagement programs, characteristics and modes of action for herbicides, insecticides, fungicides, and plant growth regulators; behavior and fate of pesticides in soil; and the development and management of pesticide resistant pest populations.

Prerequisite: C- or better in CS 200

*Typically offered in Spring only*

**CS 480/HS 480 Sustainable Food Production (capstone)** (1 credit hours)

This course introduces students to the process of developing a project for presentation in the area of sustainable food production and food systems. Students are to synthesize and integrate knowledge acquired in previous course work and other learning experiences and to apply theory and principles in a situation that approximates some aspect of professional practice. Students are expected to present their projects at the end of the semester in a PowerPoint style format to faculty and student peers.

Prerequisites: Senior standing and CS 430

*Typically offered in Fall and Spring*

**CS 502/HS 502/PP 502 Plant Disease: Methods & Diagnosis** (2 credit hours)

Introduction to the basic principles of disease etiology in plants and the methods used to research and diagnose plant diseases caused by bacteria (and other prokaryotes), fungi (and oomycetes), nematodes and viruses. Lab-based course intended to give graduate students a practical, hands-on research experience for diagnosing and characterizing each plant pathogen group. Introduction to pathogen-specific as well as more general experimental techniques utilized in plant pathology. No course prerequisites, but prior experience in microbiology and/or completion of PP 315, PP 501 or equivalent will benefit the PP 502 learning experience.

Prerequisite: Graduate standing or department consent

*Typically offered in Fall only*

**CS 514/CS 414 Weed Science** (4 credit hours)

Introduces topics fundamental to the discipline of weed science. Lecture topics include losses caused by weeds, weed biology, weed ecology, biological, chemical, cultural, and mechanical weed control, herbicide modes of actions, uses, and symptomology, and herbicide resistance. In addition, students will be introduced to weed management in various facets of agriculture through guest lectures from a wide range of NC State faculty with weed management responsibilities. Guest lectures include weed management in traditional row crops, aquatics, turf, tobacco, vegetables, ornamentals, pastures and hay crops, organic systems, and tree fruit.

*Typically offered in Fall only*

**CS 518/CS 418 Introduction to Regulatory Science in Agriculture** (3 credit hours)

This course covers laws, regulations and agencies involved in the registration of conventional, biotechnology and biological crops, crop protectants and growth regulators. US and International laws and regulations will be discussed from technical proof of concept through commercial release.

*Typically offered in Fall only*

**CS 524/CS 424 Seed Physiology** (3 credit hours)

This course will explore the physiological processes associated with seed formation, development, maturation, germination, and deterioration of agronomic and horticultural species. We will also study the physiological aspects of seed dormancy, how dormancy is manifested and overcome in cultivated and noncultivated systems and dormancy's impact on weed seedbank ecology.

Prerequisite: PB 321 or PB 421 or FOR 303

*Typically offered in Fall only*

**CS 528/CS 428 Advanced Regulatory Science in Agriculture** (3 credit hours)

This course goes into additional depth and provides hands-on exercises concerning agriculture regulatory topics covered in CS 418/518. The course will introduce laws, regulations and agencies involved in the fertilizer, animal and waste management as well as the role of public policy in the regulatory process. CS 418/518 is a prerequisite for this class.

Prerequisite: CS 418

*Typically offered in Spring only*

**CS 530/CS 430 Advanced Agroecology** (4 credit hours)

This course applies agroecological principles and critical thinking to evaluate various agroecosystems. Students will examine food, fiber, and other commodity production systems for security, productivity, and sustainability and address the simultaneous need to protect natural environments and the biodiversity on which agroecosystems depend. Topics include discussion of national and international government policies, research programs, and education programs that influence the future application of agroecosystem principles.

P: CS 230

*Typically offered in Spring only*



**CS 535/SSC 535 Root and Rhizosphere Processes for Plant Nutrition** (3 credit hours)

The focus of this course is on the understanding of concepts and principles of plant hydro-mineral acquisition, plant adaptation to nutrient deficiencies, water and nutrient cycles in the soil, and the impact that microbial communities have on these processes. Understanding below ground biological networks and their complexity is crucial for understanding soil fertility and improving the acquisition of nutrients in natural and agroecosystems.

Prerequisite: Graduate Standing or Instructor permission  
Typically offered in Fall only

**CS 541/HS 541 Plant Breeding Methods** (3 credit hours)

Overview of plant breeding methods for advanced undergraduate and beginning graduate students. Covers principles and concepts of inheritance, germplasm resources, pollen control, measurement of genetic variances, and heterosis. Special topics include heritability, genotype-environment interaction, disease resistance, and polyploidy. In-depth coverage on methods for breeding cross-pollinated and self-pollinated crops. Prepares students for advanced plant breeding courses.

Prerequisite: ST 511, Corequisite: ST 512  
Typically offered in Fall only

**CS 565/CS 465 Turf Management Systems and Environmental Quality** (3 credit hours)

Integration of turfgrass management systems and the use of BMPs and IPM to protect environmental quality. Examination of water quality issues relative to turf. Application of Best Management Practice and Integrated Pest Management strategies. Credit cannot be received for both CS 465 and CS 565. Senior standing.

Prerequisite: CS 400 and Senior standing  
Typically offered in Fall only  
This course is offered alternate even years

**CS 590 Special Topics** (1-6 credit hours)

The study of special problems and selected topics of current interest in crop science and related fields.

**CS 601 Seminar** (1 credit hours)

Review and discussion of scientific articles, progress reports in research and special problems of interest to agronomists. Maximum of two credits allowed toward master's degree; however, additional credits toward doctorate allowed.

Prerequisite: Graduate standing  
Typically offered in Summer only

**CS 620 Special Problems** (1-6 credit hours)

Special problems in various phases of crop science. Problems may be selected or will be assigned. Emphasis on review of recent and current research. Credits Arranged.

Typically offered in Fall, Spring, and Summer

**CS 685 Master's Supervised Teaching** (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Master's student  
Typically offered in Fall and Spring

**CS 688 Non-Thesis Masters Continuous Registration - Half Time Registration** (1 credit hours)

For students in non-thesis master's programs who have completed all credit hour requirements for their degree but need to maintain half-time continuous registration to complete incomplete grades, projects, final master's exam, etc.

Prerequisite: Master's student  
Typically offered in Spring only

**CS 689 Non-Thesis Master Continuous Registration - Full Time Registration** (3 credit hours)

For students in non-thesis master's programs who have completed all credit hour requirements for their degree but need to maintain full-time continuous registration to complete incomplete grades, projects, final master's exam, etc. Students may register for this course a maximum of one semester.

Prerequisite: Master's student  
Typically offered in Spring only

**CS 690 Master's Examination** (1-9 credit hours)

For students in non thesis master's programs who have completed all other requirements of the degree except preparing for and taking the final master's exam.

Prerequisite: Master's student  
Typically offered in Spring only

**CS 693 Master's Supervised Research** (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Master's student  
Typically offered in Fall, Spring, and Summer

**CS 695 Master's Thesis Research** (1-9 credit hours)

Thesis research.

Prerequisite: Master's student  
Typically offered in Fall, Spring, and Summer

**CS 696 Summer Thesis Research** (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Master's student  
Typically offered in Summer only

**CS 699 Master's Thesis Preparation** (1-9 credit hours)

For students who have completed all credit hour requirements and full-time enrollment for the master's degree and are writing and defending their thesis.

Prerequisite: Master's student  
Typically offered in Spring and Summer

**CS 701 Breeding for Insect Resistance and Abiotic Stress** (2 credit hours)

This course will cover the basic principles of breeding for insect resistance and abiotic stress. Topics include plant defenses, interactions between pest or stress and plant and environment, types of resistance, methods of breeding and screening.

Prerequisite: CS 413, CS 541, or GN 311; Students who believe to have acquired a similar background through different courses should contact the instructor or the director of the program.

*Typically offered in Fall only*

**CS 714 Crop Physiology: Plant Response to Environment** (3 credit hours)

Examines interactions between plants and the environment. Light environment, plant canopy development, photosynthesis, source-sink relations, growth regulation, water relations, and environmental stresses are addressed.

Prerequisite: Graduate Standing

*Typically offered in Fall only*

**CS 716/HS 716 Weed Biology** (3 credit hours)

This course analyzes the interactions between human disturbance and dynamics of weed populations and communities. Emphasis is given to factors that drive weed control actions and the ecological and evolutionary processes by which weeds survive and adapt to these actions. Similarities and differences between weeds and invasive plant species are discussed as well as benefits and limitations of using traditional ecological theory from natural systems to explain weed behavior in highly disturbed environments.

Prerequisite: CS 414

*Typically offered in Spring only*

**CS 717/HS 717 Weed Management Systems** (1 credit hours)

Weed management systems including integration of cultural, biological, mechanical and chemical methods for vegetables, fruits, ornamentals, turf, small grains, corn, tobacco, cotton, peanuts, aquatic and non-cropland settings. Taught second 5 weeks of semester. Drop date is by last day of 3rd week of minicourse.

Prerequisite: CS 414

*Typically offered in Fall only*

**CS 720/GN 720/HS 720 Molecular Biology In Plant Breeding** (3 credit hours)

Theory and principles of molecular biology applied to plant breeding. Understanding of the relationship between genes and crop traits. Principles and molecular mechanisms of crop traits, and their applications to solve breeding problems and improve crop traits, which include heterosis, male/female sterility, self-incompatibility, polyploidy, double haploid, protoplast fusion, random mutagenesis, plant regeneration, transgenic breeding, advanced genome editing for breeding, gene silencing, gene activation, gene drive, plant synthetic biology, metabolic engineering, epigenetics for trait improvement, gene stacking, decoy and R genes, and bioconfinement.

P: CS 211 or GN 311 or equivalent, and PB 421 or equivalent.

*Typically offered in Spring only*

**CS 725/HS 725/SSC 725/TOX 725 Pesticide Chemistry** (1 credit hours)

Chemical properties of pesticides including hydration and solvation, ionization, volatilization, lipophilicity, molecular structure and size, and reactivity and classification according to chemical description, mode of action or ionizability. Taught during the first 5 weeks of semester. Drop date is last day of 3rd week of the minicourse.

Prerequisite: (CH 201 or CH 203) and (CH 221 or CH 225)

*Typically offered in Fall only*

**CS 726/ANS 726/FOR 726 Advanced Topics In Quantitative Genetics and Breeding** (3 credit hours)

Advanced topics in quantitative genetics pertinent to population improvement for quantitative and categorical traits with special applications to plant and animal breeding. DNA markers - phenotype associations. The theory and application of linear mixed models, BLUP and genomic selection using maximum likelihood and Bayesian approaches. Pedigree and construction of genomic relationships matrices from DNA markers and application in breeding.

Prerequisite: ST 511, Corequisite: ST 512

*Typically offered in Fall only*

**CS 727/HS 727/SSC 727/TOX 727 Pesticide Behavior and Fate In the Environment** (2 credit hours)

Sorption/desorption, soil reactivity, movement, volatilization, bioavailability, degradation and stability of pesticides in the environment. Taught during the last 10 weeks of semester. Drop date is last day of 3rd week of the minicourse.

Prerequisite: CS(HS,SSC,TOX) 725,SSC 200

*Typically offered in Fall only*

**CS 729/HS 729 Herbicide Behavior In Plants** (2 credit hours)

Chemical, physiological and biochemical actions of herbicides in plants including uptake, translocation, metabolism and mechanism of action.

*Typically offered in Fall only*

**CS 745/GN 745/HS 745 Quantitative Genetics In Plant Breeding** (1 credit hours)

Theory and principles of plant quantitative genetics. Experimental approaches of relationships between type and source of genetic variability, concepts of inbreeding, estimations of genetic variance and selection theory.

Prerequisite: CS(GN, HS) 541, ST 712, course in quantitative genetics recommended

*Typically offered in Spring only*

*This course is offered alternate years*

**CS 746/GN 746/HS 746 Cytogenetics in Plant Breeding** (2 credit hours)

Theory and principles of plant breeding methodology including population improvement, selection procedures, genotypic evaluation, cultivar development and breeding strategies.

*Typically offered in Spring only*

*This course is offered alternate years*

**CS 755 Applied Research Methods and Analysis for Plant Sciences** (3 credit hours)

Students will gain understanding of the common principles of scientific method. They will gain knowledge and experience with planning for research, developing research objectives, methodology considerations, experimental design, statistical analyses, and presentation of data. Class will have a heavy focus on experimental methods in applied plant science research.

Prerequisite: ST 511

*Typically offered in Fall only*

**CS 795 Special Topics** (1-6 credit hours)

The study of special problems and selected topics of current interest in crop science and related fields.

**CS 801 Seminar** (1 credit hours)

Review and discussion of scientific articles, progress reports in research and special problems of interest to agronomists. Maximum of two credits allowed toward master's degree; however, additional credits toward doctorate allowed.

Prerequisite: Graduate standing

*Typically offered in Fall and Spring*

**CS 820 Special Problems** (1-6 credit hours)

Special problems in various phases of crop science. Problems may be selected or will be assigned. Emphasis on review of recent and current research. Credits Arranged.

*Typically offered in Fall, Spring, and Summer*

**CS 860/GN 860/HS 860 Plant Breeding Laboratory** (1 credit hours)

Visitation of plant breeding projects in the Depts. of CS and HS at NC State, along with commercial seed companies. Discussion and viewing of breeding objectives, methods and equipment and teaching and practice of hybridization methods.

Prerequisite: HS 541 or CS 541

*Typically offered in Spring only*

*This course is offered alternate even years*

**CS 861/GN 861/HS 861 Plant Breeding Laboratory** (1 credit hours)

Visitation of plant breeding projects in the Depts. of CS and HS at NC State, along with commercial seed companies. Discussion and viewing of breeding objectives, methods and equipment and teaching and practice of hybridization methods.

P: CS 741 or GN 741 or HS 741

*Typically offered in Fall only*

*This course is offered alternate even years*

**CS 885 Doctoral Supervised Teaching** (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Doctoral student

*Typically offered in Fall and Spring*

**CS 890 Doctoral Preliminary Examination** (1-9 credit hours)

For students who are preparing for and taking written and/oral preliminary exams.

Prerequisite: Doctoral student

*Typically offered in Spring and Summer*

**CS 893 Doctoral Supervised Research** (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Doctoral student

*Typically offered in Fall and Spring*

**CS 895 Doctoral Dissertation Research** (1-9 credit hours)

Dissertation research.

Prerequisite: Doctoral student

*Typically offered in Fall, Spring, and Summer*

**CS 896 Summer Dissertation Research** (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Doctoral student

*Typically offered in Summer only*

**CS 899 Doctoral Dissertation Preparation** (1-9 credit hours)

For students who have completed all credit hour, full-time enrollment, preliminary examination, and residency requirements for the doctoral degree, and are writing and defending their dissertations.

Prerequisite: Doctoral student

*Typically offered in Fall, Spring, and Summer*