Maryland CTE Programs of Study

Agriculture Crop Science II (2025)

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Introduction. 2

A **Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.** 2.A

B **The Agriculture Career Cluster concentrates on scientific advancement of agriscience, cultivation, processing, and distribution of agricultural products, employing advanced technologies and sustainable practices to optimize global food systems. This Cluster also supports other plant- and animal-based industries including regenerative agriculture, sustainable logging, and fisheries. This Cluster has meaningful connections with the Energy and Natural Resources Cluster, highlighting a symbiotic relationship that emphasizes stewardship and resilient communities.** 2.B

C **The Agriculture Science Career & Technical Education Program of Study begins with Agriculture Science I, a common foundations course covering plant and animal biology, soils, water, and sustainable food systems. From there, districts may offer one or both two-course pathways: Crop Science II–III, which prepares students for the BASF Plant Science certification while using drone and satellite imagery in labs that align with both the University of Maryland's PLSC 112 Introductory Crop Science and the University of Maryland Eastern Shore's PLSC 184 Introduction to Plant Science; and Animal Science II–III, which culminates in the Elanco Fundamentals of Animal Science credential and capstone projects that map to UMD's ANSC 101 Principles of Animal Science as well as UMES's ANPT 114 Introduction to Animal Science. The Animal Science pathway also lays the academic and clinical groundwork for an optional fourth- level Veterinary Medicine IV course, enabling students to pursue the Elanco Veterinary Medicine certification.** 2.C

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D **In Agriculture Science – Crop Science II, students collect and interpret soil and tissue tests, calibrate (model) sprayers, calculate seeding and fertilizer rates, and explore precision-ag tools such as phone-based GIS mapping. By spring, students review BASF Plant Science blueprint domains and sit for the certification exam. All performance tasks map directly to the lecture and lab topics found in the University of Maryland's PLSC 112 Introductory Crop Science course.** 2.D

E **Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.** 2.E

F **Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.** 2.F

Knowledge and Skills. 3

A **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:** 3.A

1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills. 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5
6. Implement safety procedures, including proper handling of hardware and following cybersecurity guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the agriculture science field, following data privacy laws and best practices for security. 3.A.7
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting. 3.A.8

B **The student identifies various career pathways in the agriculture science field. The student is expected to:** 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in agriculture science. 3.B.1
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations. 3.B.2
3. Demonstrate effective interview skills for roles in agriculture science. 3.B.3

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C **The student develops technology and digital literacy skills. The student is expected to:** 3.C

1. Apply secure file-management practices (e.g., clear naming conventions, logical folder structures, routine backups, and version control) when handling digital documents, GIS layers, sensor logs, and drone imagery. 3.C.1
2. Evaluate the credibility and reliability of online resources—such as peer-reviewed journals, extension databases, and regulatory websites—to inform agriscience decisions and validate research findings. 3.C.2
3. Demonstrate safe, ethical, and legal use of digital platforms by following data-privacy laws, honoring software licenses and fair-use guidelines, and sharing geospatial or aerial imagery responsibly. 3.C.3
4. Collaborate effectively through cloud-based tools (shared drives, real-time documents, virtual whiteboards, project-management apps) to coordinate tasks, exchange data, and communicate with peers, mentors, and industry partners. 3.C.4
5. Integrate multiple software applications (spreadsheets, GIS programs, drone-flight planners, sensor dashboards, and basic statistical packages) to analyze and visualize data that support precision agriculture, animal-enterprise management, and sustainability decisions. 3.C.5

D **The student integrates core academic skills into plant science practices. The student is expected to:** 3.D

1. Apply mathematical concepts—including ratio, proportion, algebraic equations, and introductory statistics—to balance livestock rations, calibrate field equipment, compute medication dosages, and analyze yield- or growth-rate data. 3.D.1
2. Design and conduct scientific investigations by formulating testable hypotheses, controlling variables, collecting quantitative and qualitative data, and interpreting results with spreadsheets or graphing tools. 3.D.2
3. Produce clear, well-organized technical documents (lab reports, research briefs, standard- operating procedures) that follow accepted formatting and citation styles such as APA or MLA. 3.D.3
4. Read, interpret, and synthesize complex informational texts (peer-reviewed articles, extension bulletins, regulatory guidelines, product labels) to support evidence-based decision-making in crop and animal sciences. 3.D.4
5. Present findings to diverse audiences through oral presentations, data-rich posters, and multimedia formats, employing effective visuals, precise terminology, and audience- appropriate explanations 3.D.5

E **The student demonstrates the necessary skills to analyze the structure and function of crop plants and relate key physiological processes to growth and adaptation. The student is expected to:** 3.E

1. Identify and label roots, stems, leaves, flowers, fruits, and seeds of major Mid-Atlantic field and horticultural crops, explaining their functions in photosynthesis, respiration, and reproduction. 3.E.1

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2 Compare C3, C4, and CAM photosynthetic pathways and infer how each influences geographic adaptation and water-use efficiency. 3.E.2

3 Measure photosynthetic rate or relative chlorophyll content with a classroom leaf-disk assay or a smartphone/SPAD meter, recording data with SI units in a standardized lab report. 3.E.3

4 Explain how environmental factors (light, temperature, water, nutrients) and plant-growth regulators affect germination, vegetative growth, flowering, and senescence. 3.E.4

5 Evaluate plant health using diagnostic keys and relate visible symptoms to underlying physiological disorders (e.g., chlorosis linked to Fe deficiency). A Comprehensive CTE Solutionapp.testudo.umd.edu. 3.E.5

F The student demonstrates the necessary skills to apply genetic principles and modern biotechnology to crop improvement. The student is expected to: 3.F

1 Predict monohybrid and dihybrid segregation ratios using Punnett squares and explain the genetic basis of hybrid vigor in staple crops such as corn. 3.F.1

2 Interpret sample marker-assisted-selection data provided by a seed company (tables or gel images) to confirm inheritance of selected alleles—no wet-lab DNA extraction required. 3.F.2

3 Design a small-plot breeding experiment that selects for a target trait (e.g., disease resistance), including data-collection and statistical-analysis plans. 3.F.3

4 Interpret basic molecular data (gel images or SNP tables) to confirm inheritance of selected alleles. 3.F.4

5 Describe germplasm preservation strategies (seed banks, in-situ conservation) and their role in global food security. 3.F.5

G The student demonstrates the necessary skills to plan, establish, and manage sustainable crop-production systems. The student is expected to: 3.G

1 Collect and analyze soil samples for texture, pH, organic matter, and macronutrients; recommend lime and fertilizer rates using regional extension guidelines. 3.G.1

2 Calculate seeding rates and plant populations for corn, soybean, wheat, and one specialty crop, adjusting for germination percentage and row spacing. 3.G.2

3 Compare conventional, conservation-tillage, and no-till systems, assessing their effects on soil health, fuel use, and greenhouse-gas emissions. 3.G.3

4 Map a field or school garden with a handheld GPS unit or free phone-based GIS app to illustrate variable-rate seeding/fertilizer zones. 3.G.4

5 Describe post-harvest handling, storage, and quality-assurance practices that maintain crop value and reduce losses. A Comprehensive CTE Solutionapp.testudo.umd.edu. 3.G.5

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The student demonstrates the necessary skills to diagnose crop pests and nutrient problems and implement safe, effective control strategies. The student is expected to: 3.H

1. Identify common Mid-Atlantic weeds, insect pests, and diseases using dichotomous keys or digital diagnostics; describe their life cycles and economic thresholds. 3.H.1
2. Develop an IPM plan that integrates cultural, biological, mechanical, and chemical tactics, including resistance-management and pollinator-protection practices. 3.H.2
3. Perform mock sprayer calibration on a tabletop spray-boom model or full-size equipment if available; compute pesticide rates in compliance with label directions. 3.H.3
4. Use plant-tissue or sap tests to detect nutrient deficiencies and propose corrective fertilization or foliar-feeding strategies. 3.H.4
5. Evaluate environmental risks (runoff, volatilization, worker exposure) and outline mitigation measures such as vegetative buffer strips and personal protective equipment. 3.H.5

I The student demonstrates the necessary skills to manage water resources efficiently and protect environmental quality in crop systems. The student is expected to: 3.I

1. Define watershed boundaries for a school-based field site and measure key water-quality parameters (pH, turbidity, nitrates). 3.I.1
2. Design an irrigation schedule using evapotranspiration data, soil-moisture sensors, or crop- growth stages to maximize water-use efficiency. 3.I.2
3. Compare surface, sprinkler, drip, and subsurface-drip irrigation methods for capital cost, labor, and water savings. 3.I.3
4. Explain how cover crops, contour farming, vegetative buffers, and nutrient-management plans reduce erosion and non-point-source pollution. 3.I.4
5. Calculate estimated carbon sequestration or greenhouse-gas reduction attributable to conservation tillage or cover-crop adoption. A Comprehensive CTE Solution. 3.I.5

J The student demonstrates the necessary skills to evaluate the historical development, economic importance, and cultural significance of major crops. The student is expected to: 3.J

1. Trace the domestication pathways of corn, wheat, and soybeans, highlighting centers of origin and key genetic improvements. 3.J.1
2. Analyze regional and global market trends for at least two commodity crops, using USDA or FAO data to calculate breakeven prices and gross margins. 3.J.2
3. Discuss how policies (e.g., biofuel mandates, GMO labeling) and trade agreements influence crop choices and profitability for U.S. producers. 3.J.3
4. Create an outreach artifact (podcast, infographic, or FFA Ag-Issues presentation) that communicates the socio-economic impact of a chosen crop on local communities. 3.J.4

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5 Update the student's Supervised Agricultural Experience (SAE) record book to include crop- production data and reflections aligned to BASF certification evidence requirements. 3.J.5

6 Evaluate the economic contribution of Maryland's field, horticultural, and nursery industries to state GDP and employment. 3.J.6

7 Assess how common Mid-Atlantic crop-production practices affect Chesapeake Bay water quality, soil health, and wildlife habitat, proposing BMPs that mitigate negative effects. 3.J.7