Maryland CTE Programs of Study

Agriculture Crop Science III (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 III, learners analyze drone or satellite imagery, build prescription maps, compare gene-editing and conventional breeding strategies, and complete a capstone research project presented at an FFA Agriscience Fair or local symposium. Economic analysis of carbon-smart practices and global commodity trends prepares students for collegiate agronomy labs.** 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 evaluate how complex anatomical and morphological traits influence crop performance under variable environments. 3.E

1. Dissect and microscopically compare vascular arrangements, root architectures, and reproductive structures of C3, C4, and CAM crops, relating form to resource capture and stress tolerance. 3.E.1
2. Estimate photosynthetic or transpiration rates with a free smartphone gas-exchange app or share an IRGA sensor borrowed from an extension partner; analyze genotype × environment interactions. 3.E.2

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3 Model phenological development (growing-degree-days) for three regional crops and predict shifts under projected climate scenarios. 3.E.3

4 Correlate anatomical adaptations (e.g., aerenchyma, leaf pubescence) with ecological niches—from flooded rice paddies to semi-arid sorghum fields. 3.E.4

5 Present findings in a scientific poster that interprets how morphology and physiology guide varietal selection and cultural practices. University of Maryland CatalogTestudo. 3.E.5

F The student demonstrates the necessary skills to design and critique modern crop- improvement strategies that enhance yield, quality, and resilience. The student is expected to: 3.F

1 Construct a breeding scheme that integrates conventional hybridization with marker- assisted or CRISPR-based selection for a target trait (e.g., disease resistance). 3.F.1

2 Analyze simplified SNP tables (provided by the teacher or online database) to identify candidate alleles—no commercial bioinformatics license required. 3.F.2

3 Evaluate regulatory frameworks and public-perception issues surrounding genetically modified and gene-edited crops; debate ethical considerations in a structured Socratic seminar. 3.F.3

4 Explain how doubled-haploid, speed-breeding, and participatory-breeding methods accelerate genetic gain in public and private programs. 3.F.4

5 Curate a seed-bank proposal that documents heritage varieties, defines rejuvenation protocols, and justifies conservation for future food-security needs. University of Maryland Catalog. 3.F.5

G The student demonstrates the necessary skills to deploy geospatial and sensor technologies for site-specific crop management decisions. The student is expected to: 3.G

1 Collect multispectral imagery using a shared drone or free Sentinel satellite data; calculate NDVI or NDRE indices and delineate within-field management zones. 3.G.1

2 Build a prescription map that integrates yield-monitor data, soil grids, and remote-sensing layers to variable-rate seed, fertilizer, or irrigation applications. 3.G.2

3 Demonstrate GPS guidance accuracy with a school tractor or desktop simulator if RTK equipment is not accessible. 3.G.3

4 Perform economic and environmental ROI analyses comparing blanket vs. site-specific inputs for one commodity crop. 3.G.4

5 Document the workflow in a digital agronomy log that meets BASF Plant Science evidence requirements and supports articulation to university lab expectations. 3.G.5

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The student demonstrates the necessary skills to design whole-farm systems that balance productivity, resource stewardship, and climate-smart goals. The student is expected to: 3.H

1. Conduct a whole-farm carbon and nutrient audit; propose practices (cover crops, reduced tillage, biochar) that lower greenhouse-gas intensity. 3.H.1
2. Compare integrated crop–livestock, alley-cropping, and perennial-grain systems for biodiversity, soil health, and net returns. 3.H.2
3. Develop a water-budget model that pairs deficit-irrigation strategies with drought-tolerant genetics for climate-risk mitigation. 3.H.3
4. Evaluate policy instruments (e.g., USDA Climate-Smart Commodities, carbon markets) that incentivize sustainable production; write a policy brief for a local producer. 3.H.4
5. Implement and monitor a conservation practice on the school farm or SAE site; analyze pre- and post-practice soil- or water-quality metrics. Digital Commons 3.H.5

I The student demonstrates the necessary skills to assess how historical domestication, cultural contexts, and market forces shape modern crop systems. The student is expected to: 3.I

1. Produce a comparative timeline of wheat, maize, rice, and soybean domestication, highlighting key genetic bottlenecks and diffusion routes. 3.I.1
2. Analyze global supply-and-demand datasets (USDA/FAS, FAO) to explain price volatility and its impact on producer decision-making. 3.I.2
3. Investigate cultural uses of a selected staple in gastronomy, ritual, and identity; present an oral history interview or mini-documentary. 3.I.3
4. Model the ripple effects of trade barriers or phytosanitary regulations on regional cropping patterns. 3.I.4
5. Update SAE financial records to include enterprise budgets, cost-of-production, and gross- margin calculations aligned with GenEd expectations of PLSC 112. 3.I.5

J The student demonstrates the necessary skills to synthesize crop-science knowledge through inquiry, professional documentation, and leadership activities. The student is expected to: 3.J

1. Design and execute an independent or team research trial aligned to one of the Standards E–H themes; apply appropriate statistical analyses (ANOVA, regression). 3.J.1
2. Write a formal research paper modeled on PLSC 112 lab-report guidelines or create a shortened scientific brief if class time is limited. 3.J.2
3. Deliver a conference-style presentation or poster at an FFA Agriscience Fair, state science expo, or university field day; respond to judge questions with evidence-based arguments. 3.J.3
4. Assemble a digital portfolio containing certification credential, SAE records, project abstracts, and reflective essays; map artifacts to PLSC 112 learning objectives. 3.J.4

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5 Develop an individualized post-secondary plan outlining dual-enrollment options, scholarship opportunities, and undergraduate research prospects in agronomy or plant science. 3.J.5