SUSTAINABILITY SPECIALTY
CERTIFIED CROP ADVISER EXAM

PERFORMANCE OBJECTIVES

The American Society of Agronomy

Certified Crop Adviser Program

Effective April 2017

SUSTAINABILITY SPECIALTY CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

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FOREWORD

The Certified Crop Adviser (CCA) program is predicated on the concept that there is a basic set of knowledge and experience that one must know in order to provide sound advice to producers. The role of the CCA in agricultural production and their relationship to producers has grown over the life of the certification program and continues to grow alongside ever-evolving agricultural standards and practices, which include economic, environmental, and social considerations. With that in mind, the CCA program, with support from the United Soybean Board, has undertaken development of a Sustainability Specialty to meet the growing demand for information and advice from producers facing requests to utilize and document sustainable practices.

The purpose of implementing a Sustainability Specialty is to utilize CCAs to help farmers/producers to become better acquainted with and adopt/enhance/implement sustainability concepts, stewardship, and best management practices within their operations. CCAs are the single best influencers to work with local producers and help them adopt more sustainable crop production practices that will satisfy the future demands of the food industry and address demands from consumers for safe food, while protecting the environment and preserving natural resources.

Performance Objectives (POs) are the heart of the CCA Program. They outline the basic knowledge and skills required by individuals providing advice to crop producers. Like all CCA POs, the Sustainability Specialty POs are also dynamic, and are upgraded as the needs evolve to ensure that the POs reflect the state of the practice. This will help to ensure that the CCA Sustainability Specialty will remain a viable and useful tool that recognizes the high level of competence displayed by those who choose to earn this designation.

The POs are divided into three Proficiency Areas: Communicating Sustainability; Environmental and Resource Stewardship; and Value Chain. Each Proficiency Area contains several Competency Areas, which identify needed knowledge and skill areas. Within each Competency Area are specific POs which describe the knowledge needed to demonstrate competency. All of the questions on the Sustainability Specialty Exam are based directly on these POs.

The Sustainability Specialty Work Group gratefully acknowledges the support of the United Soybean Board in developing this specialty. In addition, thanks to those that have provided the foundation of agricultural knowledge that this document is based upon.

The American Society of Agronomy
Certified Crop Adviser Program
Sustainability Specialty Work Group

Acronyms Used in this Document

ASABE	American Society of Agricultural and Biological Engineers
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CCA	Certified Crop Adviser
CoC	Chain of Custody
COD	Chemical Oxygen Demand
CWA	Clean Water Act
DO	Dissolved Oxygen
EC	Electrical Conductivity
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FMS	Farm Management Software
GAP	Good Agricultural Practice
GHG	Greenhouse Gas
GHP	Good Handling Practice
HEL	Highly Erodible Land
IPM	Integrated Pest Management
LCA	Life Cycle Analysis
LEPA	Low-energy, Precision Application
LESA	Low-energy, Precision Application
MESA	Mid-elevation, Spray Application
NGO	Non-Governmental Organization
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
$PM_{2.5}$	Particulate Matter 2.5 µm or less in diameter
PM_{10}	Particulate Matter 10 µm or less in diameter
SSp	Sustainability Specialist
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UAV	Unmanned Aerial Vehicle
USDA	United States Department of Agriculture
WOTUS	Waters of the United States
WUE	Water Use Efficiency

COMMUNICATING SUSTAINABILITY PERFORMANCE OBJECTIVES

Competency Area 1. Basic Concepts of Sustainability

1. Describe the essential elements included in a definition of sustainability:
    a. economic.
    b. environmental.
    c. social.
2. Describe the following concepts:
    a. Life Cycle Analysis (LCA.)
    b. externality.
    c. productivity.
    d. intergenerational equity.
    e. continuous improvement.
    f. ecosystem services.
    g. biodiversity.
    h. algal blooms, eutrophication, and hypoxia.
    i. climate change and greenhouse gas (GHG) emissions.
    j. carbon sequestration.
    k. emissions trading markets.
    l. accountability, verification and certification.
    m. best management practices.
    n. 4R Nutrient Stewardship.

Competency Area 2. Factors Driving Sustainability

1. List and define market drivers:
    a. increased supply chain efficiency and cost savings.
    b. consistency and quality of supplies.
    c. increased environmental regulation.
    d. due diligence in managing and mitigating environmental and social risk in the supply chain.
    e. consumer demand for transparency and accountability.
    f. cost savings and efficiency.

g. trading of offsets and credits.

h. accountability and reporting to supply chain programs.

2. List and describe regulatory/compliance trends associated with:

    a. nutrient management.

    b. crop protection and pest control management.

    c. agricultural product drift management.

    d. land use change and soil erosion.

    e. water resources; quantity and quality.

    f. air quality.

3. Explain the role that technology plays in the ability of producers to document and account for the impacts of their operation:

    a. record keeping.

    b. documentation and reporting.

    c. farm management software (FMS).

    d. precision agriculture.

    e. measurement tools (e.g., validated models of in-field nutrient flows).

    f. data collection and flow:

        i. on-board modems/receivers.
        ii. FMS.
        iii. third party service providers.

4. Explain the role of social media and other information outlets play in forming public opinion about the impacts of agriculture and food quality.

Competency Area 3. Identifying and Communicating Outcomes

1. Identify key performance indicators:

    a. economic.

    b. environmental.

    c. social.

2. Evaluate and discuss values and priorities of different stakeholders.

3. Understand the costs and benefits of implementing sustainability practices.

Competency Area 4. Engagement with Stakeholders

1. List the primary factors associated with Best Management Practice (BMP) adoption:
    a. weather/climate.
    b. legal framework.
    c. policies.
    d. land tenure.
    e. technologies.
    f. financing.
    g. prices.
    h. logistics.
    i. management ability.
    j. soil characteristics.
    k. crop demand.
    l. potential losses.
2. Discuss influential and trusted stakeholder groups in a community with regard to BMP adoption.
3. Describe how stakeholder input can be engaged for setting farm sustainability goals.

ENVIRONMENTAL AND RESOUCE STEWARDSHIP PERFORMANCE OBJECTIVES

Competency Area 1. Land

1. Soil health
    a. Evaluate the effects of different crop management practices on soil physical, chemical, and biological characteristics:
        i. applying nutrients in amounts below, at, or above the amounts removed with crop harvest.
        ii. rhizosphere changes and the effects on the flow of water and nutrients to plants.
        iii. crop rotations.
        iv. monocropping.
        v. pasture, silvo-pastoral systems, agroforestry, and forestry farming.
        vi. permanent crops including grape vines, coffee, orchards (fruit and nut), tree farms, trees used to produce syrup.
        vii. protected planting systems such as temporary tunnels and greenhouses.
        viii. mechanisms and risks of erosion from growing a high biomass crop versus a low biomass crop.
    b. Discuss the effects of maintaining a continuously living root system (through cover crops, perennial crops, or others) on soil biological communities, nutrient cycling, and soil structure.
    c. Delineate the basic elements of a nutrient management plan that includes manure and legumes.
    d. Compare cropping systems and how they can affect carbon sequestration.
2. Discuss the importance of deploying soil health assessment tools in improving on-farm sustainability.
3. Summarize national programs and evaluate management strategies to protect highly erodible lands (HEL).
4. Explain the role of conservation buffers in achieving greater on-farm sustainability from the perspective of soils, water quality, pests and diseases, and biodiversity.
5. Discuss how crop rotation and cover crops can impact crop input use efficiencies.
6. Recognize how any factor influencing crop yield also influences crop nutrient use efficiency.
7. Describe the contributions of a well-functioning Integrated Pest Management (IPM) system on environmental impacts (e.g., beneficial organisms, pollinators, water quality, and air quality).
8. Evaluate how IPM strategies can improve input use efficiency.
9. Discuss how adjacent, diverse land habitat management can effect pest management strategies.

10. Estimate how differing cropping and land use systems can facilitate or prove detrimental to wildlife habitats and conservation areas.
11. Explain, in general, how states' wildlife action plans could be included as an element of environmental sustainability on the farm.
12. Explain how federal and state Endangered Species Acts (ESA) effect on-farm management strategies.
13. Evaluate current tools to assess the effects of land management on:
    a. air quality.
    b. downstream surface water quality.
    c. groundwater quality.
    d. energy use.

Competency Area 2. Water

1. Describe measures of water quality:
    a. Electrical Conductivity (EC).
    b. Total Dissolved Solids (TDS).
    c. Total Suspended Solids (TSS).
    d. Biochemical Oxygen Demand (BOD).
    e. Chemical Oxygen Demand (COD).
    f. pH.
    g. Dissolved Oxygen (DO).
    h. temperature.
    i. pathogenic organisms.
    j. nutrients.
    k. fecal coliform.
2. Differentiate between dissolved and particulate pollutants.
3. Describe the influence of agricultural drainage systems (surface and tile) on downstream surface water and groundwater quality.

4. Describe the influence of cropping systems on surface water and groundwater quality:
    a. general crop management
        i. tillage practices.
        ii. nutrient application (including right source, time, rate, and placement).
        iii. crop protection applications.
        iv. harvest.
        v. over-winter.
        vi. fallow.
    b. on-site and downstream water quality protection.
    c. control of water quantity and erosion by water.
    d. control of soil and contaminant movement by wind.
5. Identify and list the advantages and limitations of mitigation strategies to reduce downstream effects on surface water quality:
    a. practices applied at the edge of field.
    b. drainage structures (including tile outlets).
    c. buffers.
    d. tillage practices.
    e. digesters.
    f. tank loading/cleaning areas.
    g. yard and storage area drainage.
    h. impervious surfaces.
6. Evaluate irrigation Water Use Efficiency (WUE) using different irrigation methods:
    a. sprinkler
        i. high-pressure.
        ii. MESA (mid-elevation, spray application).
        iii. LESA (low-elevation, spray application).
        iv. LEPA (low-energy, precision application).
    b. drip.
    c. subsurface.
    d. furrow/flood.
7. Discuss protection of irrigation water sources (aquifers, reservoirs/surface waters) in relation to WUE and demands from other water use needs.
8. Estimate the incremental energy costs for different types of crop irrigation.

9. Describe watershed management strategies and the importance of synthesizing involvement from all interested parties:
    a. farmers.
    b. municipalities.
    c. conservation/watershed management associations/districts/organizations.
    d. rural inhabitants.
    e. recreational water users.
    f. environmental groups.
10. Understand and explain water-related regulatory and policy programs and their implications/influence with respect to on-farm management decisions related to sustainability:
    a. the definition of Waters of the U.S. (WOTUS) in the Clean Water Act (CWA) in relation to what lands may be cultivated.
    b. CWA NPDES (National Pollutant Discharge Elimination System) permits.
    c. CWA non-point source pollution control programs implemented by states.
    d. TMDL (Total Maximum Daily Load) program under the CWA.
    e. USDA-NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service) conservation programs.
    f. State or regional water districts.

Competency Area 3. Air Quality

1. Identify sources of GHGs potentially emitted from farm operations including but not limited to:
    a. equipment operation.
    b. crop drying.
    c. transport: field to storage and field to market.
    d. nitrous oxide emission.
    e. embedded GHGs: fertilizer (including manure), crop protection products, and seed production.
    f. tillage.
2. Describe the potential positive and negative impacts of agriculture on GHG levels in the atmosphere.
3. Explain the LCA methodology used to measure the GHG footprint of a farm operation.
4. Identify sources of GHG emissions throughout the lifecycle of a farm operation.

5. Analyze management options to reduce the following GHGs associated with agricultural production:
    a. carbon dioxide.
    b. methane.
    c. nitrous oxide.
6. Identify sources and sinks that affect carbon sequestration.
7. Identify sources of particulates from agricultural production.
8. Define particulate matter 10 µm (microns) or less in diameter (PM_{10}), particulate matter 2.5 µm or less in diameter ($PM_{2.5}$), and EPA (Environmental Protection Agency) regulatory oversight.
9. Illustrate risk mitigation techniques for sources of particulates associated with agricultural production (PM_{10} criteria).
10. Delineate the basic elements of a manure management plan to reduce offsite movement of odors.

Competency Area 4. Energy

1. Describe largest contributing factors affecting direct and embedded energy in agricultural systems.
2. Explain why it is important from an on-farm and regulatory perspective to reduce energy usage.
3. Identify and explain components in an American Society of Agricultural and Biological Engineers (ASABE) energy audit.
4. Describe the benefits and costs of deploying the following alternative energy options to improve energy efficiency:
    a. wind.
    b. solar.
    c. biodigestors.
    d. natural gas.
    e. propane.
    f. alternate fuel types and fuel additives.
    g. on farm hydraulic technology.
5. Explain how agricultural operations can participate in, and benefit from, programs that offer credit for reducing energy usage and sequestering carbon renewable energy certificates.

VALUE CHAIN PERFORMANCE OBJECTIVES

Competency Area 1. Basic Value Chain Concepts

1. Explain components of the value chain.
2. Explain language commonly used in value chain sustainability including:
    a. ecosystem services.
    b. carbon footprint.
    c. water footprint.
    d. energy footprint.
    e. bio-feedback.
    f. sustainable intensification.
    g. Climate Smart Agriculture.
    h. sustainable/responsible sourcing.
    i. risk assessment.
    j. chain of custody.
    k. Global Reporting Initiative/Carbon Disclosure Project reporting.
    l. Annual Sustainability Report.
    m. Sustainable Supply Chain Program/Protocol.
    n. traceability.
3. Explain the importance of considering on-farm economic sustainability in addition to environmental and social sustainability.
4. Explain the ways in which a farming operation can contribute to its economic sustainability by improving its environmental and social sustainability, including:
    a. market-based ecosystem services (e.g., carbon offsets, nutrient credit trading).
    b. government conservation payment programs.
    c. increased efficiencies by reducing resource use.
    d. providing value-added products to the market-place and recouping that value.
5. Distinguish market demands for increased sustainability versus market opportunities and the implication for farming operations' economic sustainability.

Competency Area 2. Food Safety, Food Quality, Sustainability

1. Differentiate between food quality and food safety.
2. Explain the basic legal frameworks in the U.S. related to food safety, and the responsibility that these frameworks play on different actors throughout the value chain.
3. Identify potential sources of contamination that could influence food safety resulting from crop management practices up to the farm gate. Include concerns either by regulators or the public, which have resulted in product recalls and/or major economic losses for the agricultural sector:
    a. chemical, physical, biological (e.g., pathogens, toxins (e.g. aflatoxin)).
    b. cosmetic and internal.
    c. intentional and accidental.
4. Describe measures the farm operator can take to mitigate these types of food safety problems, and those that must be taken by others in the value chain:
    a. changes in operational procedures.
    b. culling of defective material.
    c. post-harvest treatments.
    d. storage under modified climate/atmosphere conditions.

Competency Area 3. Social and Economic Implications and Metrics

Many of the processors and end users of agricultural products are international companies or companies that source their inputs from multiple countries. These companies develop sustainability programs, including goals and metrics, that address inputs sourced from many areas of the world. Laws, regulations, and local customs related to farming and agricultural production often vary greatly between countries. Additionally, consumers are requesting and often demanding that sustainably sourced programs address issues related to social metrics in both developed and developing countries. It is important that CCA's operating in the area of sustainability have a general awareness of these global issues, an understanding of how these issues are addressed by laws, regulations, and customs in their home state/province and country, and how those laws and regulations are implemented on the farm by their clients.

Candidates preparing for the exam might approach these bullets by framing them into contextual questions. For instance, although labor hours, and health benefits have obvious economic relevance to the farm worker, how do they represent a social component to the success of the enterprise? Worker protection, child labor and housing are aspects of farm management that have severe legal implications. Beyond the legal questions, though, how do they also represent social considerations for growers and workers?

When we consider community and social/public expectations and food security, the emphasis on social metrics suddenly becomes very much centered on the end-users.

What recent developments in agribusiness have received heavy scrutiny from the public, which implies the need for higher awareness of public perception by the producers? And what has been the response of agribusiness to higher public scrutiny? The candidate might consider what he or she has seen on social media, that puts some ag-related into the public eye.

In short, social metrics can be interpreted as indices or elements of farm management that already have legal or economic imperatives. Social metrics can be an important bridge between agricultural professionals such as CCAs, and a public largely unaware of everyday agricultural processes.

1. Explain social metrics, such as:
    a. labor hours, including overtime.
    b. health care and disability.
    c. employee safety standards.
    d. housing.
    e. child labor.
    f. community and social expectations.
    g. food security.

Given the predication that social metrics are in essence a method by which the CCA with a SSp can relate intangible concepts to everyday agribusiness, consider the following performance objective requirements in that context:

2. Describe the market rationale for U.S. farm operations to incorporate social metrics into their operation.
    a. Understand the difference between organized labor and Non-Governmental Organization (NGO) demands and legal requirements.
3. Describe the market rationale for the application of social metrics to sourcing supplies from underdeveloped countries, and why those metrics may be different/more numerous than those applied in developed countries.
4. Identify key farm financial health indicators such as
    a. debt-to-asset ratios.
    b. balance sheets (statement of financial position).
    c. profit and loss statement (statement of financial activities).
    d. breakeven production prices.
5. Identify sources of information that could assist the operation in farm succession planning.
    a. Explain how farm succession is an important element of social sustainability to mitigate loss of family farms/keep farmers in the landscape.

Competency Area 4. Measuring and Assessing Sustainability

1. Identify current tools to assess sustainability performance in crop production, including quantitative (calculators) and qualitative (questionnaires).
2. Understand levels of validating/verifying sustainability data in crop production including.
    a. self-certification.
    b. second party verification (i.e., who the crop is sold to).
    c. outside third party verification.
3. Agribusiness is witnessing an increasing trend of heavier scrutiny of producers' attention to food safety [e.g., in the form of GAP programs]. An important aspect of food safety planning is ensuring that sourcing claims for safe, sanitary food are verifiable. This is especially true for specialty crops, where the impetus for constant improvements in food safety is provided by recent high-profile contamination cases and new federal regulations. The main concepts included in Good Agricultural Practices (GAP) & Good Handling Practices (GHP) are:
    a. Worker health and safety from workplace hazards.
    b. Proper worker hygiene before, during and after harvest.
    c. Sanitation of harvest equipment and storage/packing areas.
4. Many food products made with commodity crops are able to be traced back only to the processor, not to the origin, Chain of custody (CoC) systems were developed to provide a process to track a product from a certified farm through the various stages of buying, trading, manufacturing, and warehousing so that the claim being made on the product accurately reflects the certified content or sourcing of that product. Well known CoC systems are:
    a. traceability.
    b. mass-balance.
    c. parallel production.
    d. controlled blending.
    e. book and claim.
    f. identity preserved.
    g. segregation.

The SSp candidate should be familiar with these general concepts as they pertain to ensuring a safe and sanitary food supply is vital to agricultural sustainability. For example, a producer's accountability for his or her farm activities in the process of growing a crop is essential to sustainability. Without that accountability, the economic benefits of farming cannot be realized; and ecological harm could result depending on what practices have been adopted. Additionally, without that accountability, the implicit "social contract" between the grower and the end-users could potentially erode. The candidate is further encouraged to consider this in the context of his or her own interactions with the agribusiness community.

5. Assess the importance of maintaining and protecting ownership/privacy information of a client/customer.
    a. Explain the advantages and disadvantages of different levels of privacy/stewardship.
    b. Understand and discuss the relationship of the following terms to privacy policies:
        i. portability.
        ii. ownership.
        iii. transparency.
        iv. collection.
        v. retention.
    c. Be able to explain to growers that the data is theirs, and that any release of information to third parties could be detrimental to their interests unless covered by a written agreement on how the data will be used. Examples could include satellite and Unmanned Aerial Vehicle (UAV) monitoring.
    d. Justify why farmers should be concerned about data privacy, protection, and ownership related to participation in sustainability measurement programs.
6. Analyze and evaluate metric reports to determine opportunities for improving sustainability performance.
7. Explain the concept of continuous improvement and how it informs the design of sustainability metrics programs.
8. Summarize the regulatory programs or other legal mechanisms in the U.S. that mandate the application of sustainability indicators (nutrient management (either point or non-point under the CWA), Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), nuisance suit odor control, water quantity metering).
9. Summarize trends in non-regulatory, market-driven measurement of sustainability within the supply chain.
10. Explain the difference between practice-based and outcome-based metrics, and the rationale behind the preference for outcome-based metrics.

11. Identify and explain generally the principles and indicators commonly used in third-party evaluation systems intended for on-farm measurement of sustainability including but not limited to Field to Market (FTM), The Sustainability Consortium (TSC), International Sustainability and Carbon Certification (ISCC), Roundtable for Responsible Soy (RTRS), U.S. National Organic Program (US NOP), or many of the other ones available.
12. Explain what measurement tools these third-party systems use, including their outputs.