Nebraska
Certified Crop Adviser Program

Performance Objectives

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The Nebraska Certified Crop Adviser Board
Committee for Exams and Continuing Education
1335 H Street, Suite 100
Lincoln, NE 68508-3784
Phone: (402) 476-1528 r Fax: (402) 476-1259 r E-Mail: info@necca.org

CERTIFIED
CROP ADVISER

Introduction

Just as the International Certified Crop Adviser (CCA) Performance Objectives outline the knowledge and skill areas that advisers need in order to effectively meet their duties and responsibilities on the general scheme, the Nebraska CCA Performance Objectives have been developed to indicate the knowledge and skills needed to perform well in Nebraska's climate and cropping systems. These performance objectives are the heart of the CCA Program. They are used as the framework for test construction and the basis for continuing education programs. The Nebraska Certified Crop Advisers Board provides oversight and direction to the Committee for Exam and Continuing Education. The Board ensures that the Nebraska CCA Performance Objectives are reviewed and revised in a timely manner.

These performance objectives are dynamic. They are upgraded as needed, particularly as the technology of the crop production industry evolves. The upgrading is done by the Exam and Continuing Education Committee, which is a standing committee for the Nebraska Certified Crop Adviser Board. The upgrading process ensures that the CCA program will remain viable and useful, and that the program recognizes the high level of competency needed by individuals, who will advise producers now and in the future.

The Nebraska CCA Performance Objectives, as outlined in this document, delineate the knowledge and skills that are considered important for certified crop advisers working in Nebraska. Expertise in these areas is expected. All questions on the Nebraska CCA Exam are based on the Nebraska CCA Performance Objectives. Certified crop advisers must also demonstrate their expertise in International CCA Performance Objectives. The International CCA Exam questions are based on the International CCA Performance Objectives.

Since the International and Nebraska Performance Objectives are developed over the materials that Certified Crop Advisers need to know, It is apparent that they are the basis for the entire CCA program. The first step for persons interested in becoming a certified crop adviser is adequately mastering the material covered in the Performance Objectives, so one can pass the CCA exams (i.e. International and Nebraska). All the questions on both exams are based directly on these Performance Objectives.

The Performance Objectives serve as the guide for CCA continuing education, which is the backbone of the CCA program. Once certified, the CCA must participate in continuing education programs. These programs ensure that the CCA maintains or increases their proficiency, and maintains the integrity of the CCA program. Certified Crop Advisers should use these Performance Objectives to identify areas where they need to strengthen their proficiency.

Basic Concepts in Plant Nutrition

- Identify plant species that fix gaseous nitrogen, describe the process involved in nitrogen fixation, and identify limiting factors.

Basic Concepts in Soil Fertility

- Describe transformations of soil and fertilizer nutrients, including nitrification, denitrification, volatilization, immobilization, mineralization, fixation, and dissolution.
- Identify soil conditions that restrict or enhance nutrient availability to plants and propose ways to maintain or increase it.
- Describe means by which nitrogen can be lost from the soil and propose methods to reduce the loss.

Soil Testing and Plant Analysis

- Describe the objectives and processes of soil testing and describe its applications to the growth of plants.
- Provide instructions for taking good soil samples for nutrient analysis and fertilizer recommendations.

Nutrient Sources and Applications

- Give the desired composition of starter fertilizers and identify situations where they should be used.
- Perform computations which use rate of nutrient required to calculate rate of fertilizer recommended and vice versa.
- Select suitable application methods for fertilizers considering soil and cropping conditions, and fertilizer characteristics.
- Select common fertilizers to provide plant nutrients in selected soils and management systems.

Soil pH and Amendments

- Describe the concept of soil pH and identify ways to raise or lower it.
- Describe saline and sodic soils, identify their cropping problems, and propose means for their correction or control.

Nutrient Management Planning

- Relate ease of movement of nutrients through the soil to soil conditions and nutrient form.
- Rate organic materials as nutrient sources for plants considering their composition and carbon/nitrogen ratios.
- Define soil and plant conditions where sulfur deficiency for plants may be a problem.
- Describe the process and the products in the conversion of organic wastes into plant-available forms.

SOIL MANAGEMENT

Basic Concepts in Biological Soil Properties

- Describe the benefits and risks of livestock manure application.

Basic Concepts in Physical Soil Properties

- List approximate available water holding capacity for common soil textural classes.
- Describe the concepts of permanent wilting point, field capacity, and plant available water of soils.
- Describe how tillage affects soil structure.
- Describe how wetting/drying and freezing/thawing affects soil structure.

Basic Concepts in Erosion Processes

- Relate how the following conditions can affect the rate of erosion:
  - Soil moisture content
  - Surface crusting
  - Tillage (surface condition)
  - Standing crop residue
  - Flattened crop residue

- Explain how the following conservation practices affect sheet, rill, gully, and wind erosion:
  - Wind breaks
  - Vegetative barriers

Basic Concepts of Soil Tillage and Crop Residue Management

- Describe how the following impact the amount of soil surface residue cover:
  - Crop rotation
  - Crop yield
  - Harvesting method
  - Tillage system
  - Fertilizer and manure application
  - Weather

- Recognize the approximate residue reduction caused by common tillage practices.

- Recognize the impact of various tillage practices and systems on:
  - Nutrient availability and fertilizer application
  - Pest management and herbicide applications
  - Soil moisture content and soil temperature
  - Crop development and weed control
  - Soil structure
- Distinguish between clean till and high surface residue management systems regarding surface crusting and soil structure.

- Describe how tillage and soil surface residue cover affect soil moisture losses due to evaporation.

Basic Concepts of Restrictive Soil Layers

- Explain how tillage can both create and reduce soil compaction.

Basic Concepts of State and Federal Regulations and Policy

- Recognize the intended environmental benefits of the Environmental Quality Incentives Program.
- Identify the general provisions of the Nebraska Erosion and Sediment Control Act.
- Recognize the basic regulations dealing with ground water and surface water use in Nebraska.
- Identify the basic Natural Resources District responsibilities.

Basic Concepts in Site Characterization

- Recognize how site characteristics can affect potential ground water and surface water contamination.

WATER MANAGEMENT

Basic Concepts of Water and Contaminant Movement

- Describe how the following factors affect infiltration and runoff:
  - Soil texture
  - Soil structure
  - Soil organic matter
  - Soil surface roughness
  - Soil surface residue
- Describe the relationships among tillage, residue, surface crusting, soil structure, infiltration, and runoff.
- Describe how the following may impact contaminant movement:
  - Precipitation and runoff characteristics
  - Contaminant degradation characteristics
  - Contaminant adsorption characteristics
- Describe how the vadose zone characteristics and depth to ground water may impact contaminant accumulation in ground water.

Basic Concepts in Plant-Water Relations

- List typical daily water use and total seasonal water requirements for major Nebraska crops.
- Describe critical stages of crop growth for major Nebraska crops when adequate moisture is required.
- List the minimum allowable soil water balance (or maximum allowable soil water depletion) to prevent crop water stress in Nebraska irrigated crops.
- Describe factors that determine the amount of rainfall that will be available for crop use (effective rainfall).
- Describe practices to conserve soil moisture available for crop use in dryland production settings.

Basic Concepts in Water Quality

- Differentiate between and describe point and non-point sources of pollution.

- Explain the relationship between:
    - Parts per million
    - Parts per billion
    - Milligrams per liter
    - Micrograms per liter

- Describe the significance of the following:
    - Maximum contaminant level
    - Maximum contaminant level goal
    - Secondary maximum contaminant level
    - Health advisory level
    - Total maximum daily load

- Differentiate between chemical concentration and loading in surface water.

- Select best management practices to reduce herbicides (especially atrazine) in surface water.

- Select best management practices to reduce the potential for nitrate contamination of ground water.

Basic Concepts of Irrigation Water Management

- Calculate crop root zone soil water balance.

- Determine amount of irrigation water applied with an irrigation event.

- Describe the common methods of monitoring soil moisture status.

- Describe the common procedures for scheduling irrigation.

- Describe the basic procedures for scheduling the last irrigation of the season.

- Calculate the number of days before the next irrigation is needed and the necessary irrigation amount.
- List the factors that influence irrigation system application efficiency.

- Describe the factors to consider when selecting and designing an irrigation system.

- List the factors that impact the selection of sprinkler devices for center pivot systems.
- Describe the principles of surge irrigation application.

- Explain how to adjust irrigation schedules for electrical load management, system flow rates, and soil depth and texture.

- Describe how slope, set size, furrow flow rate, set time, and soil texture can affect the uniform application of irrigation water and leaching potential along the length of the furrow with furrow irrigation.

- Describe how furrow irrigation management changes depending on runoff control measures used (no runoff control in place, tailwater recovery system, blocked field ends).

- Describe how the sprinkler package, soil texture, slope, surface storage, runoff, topography, and wind can affect the uniform application of irrigation water with center pivot irrigation.

- Describe the factors that impact the scheduling of the first irrigation when using a center pivot.

Basic Concepts in Application of Fertilizers and Pesticides by Chemigation

- List factors to consider when selecting materials to be applied by chemigation.

- Identify the requirements of the Nebraska Chemigation Act including the requirements for installed safety devices.

- Describe how to evaluate a field site for environmental impacts of using chemigation as a means of chemical application.

- Select the equipment best suited for chemigation application of fertilizers and pesticides.

- Identify the proper procedures for calibrating a chemigation and irrigation system for chemigation purposes.

- Describe the appropriate mixing and cleanup procedures for fertilizers and pesticides applied via chemigation.

- List the specific requirements for backflow safety when manure storage or lagoon contents are mixed with irrigation water.

Basic Concepts in Livestock Environmental Issues

- Recognize potential soil and water contaminants in manure (nitrogen, phosphorus, pathogen, salts, and organic matter) and identify:
    - Environmental impact of contaminants
    - Pathways for movement to surface and ground water
    - Management principles for minimizing risk to the environment

- Describe the concept of whole farm nutrient management as it applies to integrated livestock/crop operation and:
    - Distinguish farms with significant imbalance (accumulation) of nutrients
    - Distinguish primary sources of excess nutrients
    - Choose strategies that improve the nutrient balance
    - Select management practices that reduce the quantity of nutrients in manure

- Prepare nutrient management plans for manure and other organic nutrient sources that:
    - Identify land requirements based upon livestock capacity and feeding program choices
    - Determine the quantity of manure in an overall crop nutrient program
    - Accurately credit these nutrients in an overall crop nutrient program
    - Minimize the accumulation of phosphorous in the soil
    - Provide tools for in-season monitoring of crop nitrogen status
    - Provide appropriate record keeping tools

- Formulate a process for prioritizing fields to receive manure and timing of applications that consider:
    - Runoff and erosion potential

    - Proximity to surface water
    - Crop production and cultural practices

- Identify risks associated with contaminant movement from stored and stacked manure.

- Recognize odor and nuisance risk associated with land application of manure and appropriate practices for limiting those risks.

Basic Concepts in Weed Biology

- List the life cycle of the weeds listed.

Weed List:

redroot pigweed	tansy mustard	musk thistle
common sunflower	field pennycress	plumeless thistle
common lambsquarter	henbit	Canada thistle
green foxtail	downy brome	field bindweed
barnyardgrass	cheat	common milkweed
large crabgrass	jointed goatgrass	hemp dogbane

- List the method(s) of reproduction (seed or vegetative) of the weeds listed.

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- List the relative weed competitiveness of corn, grain sorghum, soybean, and sugarbeet.

- List the relative competitiveness of foxtail, velvetleaf, sunflower, redroot pigweed, lambsquarters, and sandbur.

- Describe the critical weed free period as it relates to weed management.

Basic Concepts of Herbicides

- Classify the following postemergence herbicides as contact or translocated:

Accent	Beacon
Banvel	Basagran
2,4-D	Stinger
Buctril	Ally
Gramoxone	Liberty
Roundup	

- Classify the following herbicides based on site of action:

Select	Ally	Roundup	Atrazine
Poast	Accent	Touchdown	Sencor
Pursuit	Beacon	Liberty	Buctril

- Describe the impact of soil texture and organic matter on efficacy of soil applied herbicides.

- Describe the impact of soil texture and organic matter on herbicide leaching.

Herbicide Resistant Crop Concepts

- Understand the weed management implications of Roundup Ready, Clearfield, Liberty Link, and STS crop hybrids/varieties.

Basic Concepts of Integrated Management of Insects and Mites

- Diagnose for each of the following insects and mites each of their associated crop injury symptoms, and understand each of their life cycles.

Corn
Armyworm
Corn leaf aphid
Corn rootworms
Cutworms
European corn borer
Fall armyworm
Flea beetles
Grasshoppers
Seed corn beetles
Seed corn maggot
Stalk borer
Spider mites
White grubs
Wireworms

Soybean
Grasshoppers
Green cloverworm
Potato leafhopper
Seed corn maggot
Spider mites
Thistle caterpillar
Thrips
Woolly bears

Wheat
Russian wheat aphid
Greenbug
Chinch bug
Hessian fly
Armyworm
Army cutworm
Wheat curl mite

Alfalfa
Cloverleaf weevil
Aphids
Blister beetles
Plant bugs
Potato leafhopper
Grasshoppers
Alfalfa weevil

Grain Sorghum
Greenbug
Chinch bug
Corn leaf aphid

Dry Bean
Mexican bean beetle
Western bean cutworm

Sugar Beet
Sugarbeet root maggot
Sugarbeet root aphid

- Identify Common Predators and Parasitoids, and Their Potential Impact on Pest Insects

Lady beetles
Ground beetles
Damsel bug
Predatory mites
Parasitic wasps
Lacewing
Minute pirate bug

- Recognize the fundamental definitions of economic threshold and economic injury level and how they are used in decision-making for insect control.

- Recognize how cropping sequence or crop rotation influences the potential for occurrence of insect pests in crops.

- Recognize the influence of the following cropping practices on insects:
    - Early or late planting
    - Early or late harvest
    - Tillage
    - Weed control

- Identify the primary management strategies for the following key insect problems:
    - Corn rootworms in corn
    - Cutworms in corn
    - European corn borer in corn

- Bean leaf beetles in soybean
- Grasshoppers in corn and soybeans
- Spider mites in corn and soybean
- Alfalfa weevils in alfalfa
- Potato leafhoppers in alfalfa
- Chinch bugs in sorghum and wheat
- Greenbugs in sorghum and wheat
- Russian wheat aphid in wheat
- Wheat curl mite in wheat
- Hessian fly in wheat
- Army cutworms in wheat
- Mexican bean beetle in dry bean
- Sugarbeet root maggot in sugar beet

Basic Concepts in Plant Disease Biology

- Define the concept of disease in plants.
- Recognize the types of plant diseases.
- Relate disease development with environmental and cultural factor.
- Recognize host range of plant pathogens.

Basic Concepts Involving Signs and Symptoms of Plant Disease

- Identify key symptoms of commonly occurring diseases of field crops.

Corn	Soybean	Grain Sorghum
Gray leaf spot	Sclerotinia stem rot	Bacterial leaf stripe
Eye spot	Phytophthora root rot	Sooty stripe
Anthracnose	Cyst nematode	Downy mildew
Stalk rots	Seedling blight	Zonate leaf spot
Nematode injury	Brown stem rot	Ergot
Maize chlorotic mottle	Charcoal rot	
Maize dwarf mottle	Pod and stem blight	
Common rust	Brown spot	
Goss's wilt	Soybean rust	
Stewart's wilt	Downy mildew	
	Bean pod mottle	

Wheat	Alfalfa	Dry Edible Beans
Leaf rust	Anthracnose	White mold
Tan spot	Phytophthora root rot	Common blight
Wheat streak mosaic	Spring black stem	Halo blight
Soil-borne wheat mosaic	Summer black stem	Rust
Crown and root rot	Common leaf spot	Bacterial wilt
Stripe Rust	Downy Mildew	Fusarium root rot
Powdery Mildew		
Ergot		

Sugarbeet
Cyst nematode
Rhizomania
Rhizoctonia crown rot
Cercospora leaf spot
Aphanomyces root rot

Basic Concepts in Control and Management of Plant Diseases

- Describe the primary management strategy for the following key field crop diseases:
  - Gray leaf spot of corn
  - Stalk rot diseases of corn
  - Corn virus diseases such as maize chlorotic mottle
  - Sclerotinia stem rot of soybean
  - Soybean cyst nematode
  - Soybean seedling blight diseases
  - Wheat leaf rust
  - Wheat streak mosaic virus
  - Crown and root rots of wheat
  - Anthracnose of alfalfa
  - Spring black stem of alfalfa
  - Phytophthora root rot of alfalfa
  - Rust of dry edible beans
  - Rhizomania disease of sugarbeet
  - Soybean rust
  - Corn grain molds

Concepts in Calibration of Pesticide Application Equipment

- Identify the relative qualities of the following nozzle tip materials:
  - plastic
  - stainless steel
  - ceramic
  - brass
  - harden stainless steel

- Describe the pattern, relative droplet size, pattern overlap, and primary uses of the following nozzles type:
  - flat fan
  - even flat fan
  - hollow cone
  - flooding tip
  - venturi tip

- Know the information required to select and size a nozzle that will achieve a given application rate.

- Identify and describe characteristics of the following pumps:
  - diaphragm
  - roller
  - centrifugal
  - piston

- Know how does the following factors affect spray delivery, coverage and potential drift:
  - nozzle pressure
  - sprayer speed
  - nozzle type
  - nozzle spacing
  - nozzle height
  - weather condition
  - wind speed
  - nozzle configuration

- Identify the function of the following sprayer plumbing components:
  - throttling valve
  - tank shut-off
  - by-pass line
  - pressure relief valve
  - agitator
  - regulating valve
  - line strainer
  - anti-drip bodies

- Calculate the amount of chemical required to create a specific tank solution.

- Understand the factors of calibration and the “ounce calibration” method:
  - spray width
  - travel speed
  - nozzle discharge (gpm)

- Identify the maximum acceptable variance among nozzles on a spray boom.

- Know chemigation calibration principles.

- Identify the chemigation equipment needed to prevent groundwater contamination.

- Know the effect of climatic conditions, pesticide formulation and properties and additives on spray drift and volatilization.

- Know the Nebraska rules and regulations concerning pesticide and fertilizer storage.

Crop Management

Basic Concepts in Crop adaptation

- Describe the influence of temperature and precipitation on cropping systems options.
- Describe the influence of day length and climate on hybrid and cultivar selection, and crop adaptation.
- List the minimum, optimum, and maximum temperatures for seed germination and growth for corn, soybean, wheat, grain sorghum, and alfalfa.
- Describe the consequences of temperature and precipitation extremes on crop growth and crop quality.

Basic Concepts of Crop growth and development

- Describe the important growth stages for soybean, corn, grain sorghum, wheat, and alfalfa.
  - emergence
  - vegetative stages
  - floral initiation
  - flowering
  - grain or seed development
  - maturity
- Describe changes in water requirements during growth and development and which stages are most sensitive to stress.
- Relate crop growth stage to appropriate crop management practices for soybean, corn, grain sorghum, and wheat.
- Relate the growing degree day (GDD) concept to crop development, recognize its function in production systems, and calculate GDD for corn, grain sorghum and wheat.
- Define physiological maturity and harvest maturity in grain and seed crops.
- Compare and contrast rooting patterns of corn, grain sorghum, winter wheat, alfalfa, soybean, field bean, and sugarbeet plants.
- Discuss water use requirement differences for corn, wheat, grain sorghum, alfalfa, field bean, and soybean.
- List the yield components for corn, grain sorghum, soybean, and wheat.

Basic Concepts in Crop damage, mortality, and replant decisions

- Identify damage to agronomic crops from hail, frost, drought, wind, flooding, herbicide injury, and insect defoliation.
- Understand the consequences of this damage to plant growth and crop yield and the relationship between amount of crop damage and stage of development.
- Recognize weather and plant factors that influence the plant's ability to resume growth after injury has occurred.
- Assess crop damage and determine if replanting is necessary.

Basic Concepts of Cultivar and hybrid selection

- Describe the differences between hybrids and cultivars and how these differences influence management decisions.

- List the characteristics important for selecting hybrids and cultivars.

- Describe the basic concepts required for significance in yield test reports such as least significant difference (LSD) and T-square.

Basic Concepts of Seeds and Seeding

- List those traits used to determine seed quality.

- Calculate the data from a seed analysis when given:
  - purity
  - percent germination
  - percent weed seeds
  - percent inert matter
  - percent other crop seeds
  - pure-live seed percentage

- Calculate the seeding rate in seeds per acre, or seeds per foot of row, adjusted for pure-live seed percentage, when given the seeds per pound, row spacing, desired seeding rate, and expected field emergence.

- Discuss the effects of seed size, shape and color on planting, germination, emergence and stand establishment.

- List the three steps in the seed germination process and the environmental conditions necessary for each step.

- Define seed dormancy, list the causes and the crops in which it most commonly occurs and the techniques used to correct seed dormancy.

- Describe seed fungicide and insecticide treatments, indicate the crops on which they are most commonly used and why, and discuss the cost/benefits.

- List and describe the germination tests used to estimate field emergence and the relative value of each test.

- List and explain the factors that determine planting date, planting depth, planting method and planting rate of:

alfalfa	millet	spring small grains
corn	sorghum (forage & grain)	sunflowers
field beans	soybeans	wheat

- List the advantages and disadvantages of early and late planting of:

alfalfa	sorghum	spring small grains
corn	soybeans	wheat

- Describe the difference between seeding rate and plant population at emergence, and list the factors that affect seedling survival.

Basic Concepts in Cropping Systems

- List the advantages and disadvantages of crop rotations versus a single crop system.

- Describe possible and most likely crop rotations or single crop systems for the following areas, and indicate the economic and environmental factors which impact crop rotations in each area:
  - East of Highway 81
  - Highway 81 to Panhandle
  - Panhandle
  - Eastern Nebraska - rainfed and irrigated
  - Central Nebraska - rainfed and irrigated
  - Western Nebraska - rainfed and irrigated
  - Sandhills - irrigated

- Describe the following cropping systems and indicate where in Nebraska each system is most likely to be used:
  - Continuous cropping
  - Double cropping
  - Strip cropping
  - Ecofallow
  - Wheat fallow

- Describe the following tillage systems and indicate the advantages and disadvantages of each system for row or close seeded (drilled) crops:

  Clean tillage — Ridge till
  Conventional tillage — No till

- Distinguish among sustainable, non-sustainable, and organic cropping systems.

- Characterize the following precision agriculture terms:
  - geographic information systems (GIS)
  - global positioning systems (GPS)
  - site-specific management
  - grid soil sampling
  - smart soil sampling
  - variable rate technology (VRT)
  - yield mapping

- List the advantages and/or disadvantages of GIS/GPS in a cropping system.

- List the opportunities and limitations of GIS/GPS in a cropping system.

Basic Concepts Crop Production Economics

- Calculate profit/acre given yields, prices, and input costs.
- Describe the concepts of profit maximization and optimum inputs.