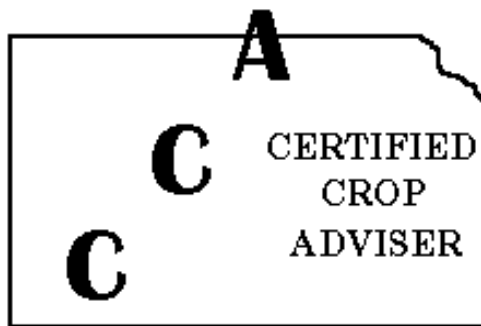


# **Kansas Certified Crop Adviser Program**

## **Performance Objectives**



Prepared by:  
**Kansas CCA Board**  
**Subcommittee on Exam Preparation**

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**Kansas Certified Crop Adviser Performance Objectives**

The Kansas State Performance Objectives are in addition of the International Performance Objectives. These objectives and the expertise within the competency areas are also guidelines for the continuing education requirement for those who qualify as a Kansas CCA.

Questions for the Kansas CCA State examination will be developed within the scope of the national and state performance objectives. The exam questions will be drawn from the four main competency areas (NOT INCLUDING WQP TOPICS) in proportion to the percentages shown below.

## COMPETENCY AREAS:

### NUTRIENT MANAGEMENT (25%)

1. Soil and nutrient interaction
2. Soil pH and liming
3. Major nutrients (N, P and K)
4. Secondary nutrients and micronutrients
5. Soil test reports and fertilizer recommendations
6. Nutrient sources
7. Soil amendments
8. *Equipment Calibration (WQP)*
9. *Waste Management (WQP)*
10. *Elements of Nutrient Management Planning (WQP)*
11. *Nutrient Import and Export (WQP)*

### SOIL AND WATER MANAGEMENT (15%)

- 1 Basic physical properties of soil
- 2 Soil water management
- 3 Soil conservation
- 4 Irrigation management
- 5 Managing for water quality
- 6 *Soil Hydrology (WQP)*
- 7 *Drainage (WQP)*
- 8 *Watershed Hydrology (WQP)*
- 9 *Ground Water Hydrology (WQP)*
- 10 *Critical Management Zones (WQP)*
- 11 *Agricultural Non-Point Source (NPS) Pollution Control (WQP)*
- 12 *Point and Non-Point Source Pollution (WQP)*

### PEST MANAGEMENT (40%)

1. Weed management
2. Plant disease management
3. Insect management
4. Integrated pest management
5. Pesticide use and safety
6. *Using Best Management Practices for water quality protection (WQP)*

### CROP PRODUCTION (20%)

1. Crop growth and adaptation
2. Basic principles of forage production
3. Planting and seeding management
4. Crop damage, mortality and factors influencing replanting decisions
5. Cropping systems
6. Site specific management

### **Water Quality Planner (WQP)**

*NRCS and EPA requirements for Nutrient Management Plans will require additional training in specific water quality management areas, especially livestock waste management.*

*Under the nutrient mgmt., soil and water mgmt., and pest management competency areas, you will notice sub-topics in italics followed by the designation "(WQP)".*

**THESE SPECIFIC TOPICS WILL NOT BE COVERED ON THE KANSAS CCA EXAM.**

*However, CEUs at various training programs and meetings can be awarded if the Water Quality Planner (WQP) topics are addressed. Contact the Kansas CCA Program at 785-234-0463 if you have any questions concerning WQP.*

## **NUTRIENT MANAGEMENT COMPETENCY AREAS:**

1. Soil and nutrient interaction
2. Soil pH and liming
3. Major nutrients (N, P and K)
4. Secondary nutrients and micronutrients
5. Soil test reports and fertilizer recommendations
6. Nutrient sources
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8. *Equipment Calibration (WQP)*
9. *Waste Management (WQP)*
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11. *Nutrient Import and Export (WQP)*

## **EXPERTISE WITHIN EACH COMPETENCY AREA:**

### **1) Soil and nutrient interaction**

- a) Recognize how soil, climatic and nutrient properties affect movement and retention of nutrients in soil or water.

### **2) Soil pH and liming**

- a) Understand the effect of soil pH plant growth
- b) Recognize how each of the following factors affect lime rate.
  - 1) type of cropping and tillage systems used
  - 2) soil characteristics
  - 3) soil pH
- c) Describe how lime quality influence lime rate.
- d) Describe the neutralizing value, physical properties and handling precautions of the following liming materials:
  - 1) calcitic limestone
  - 2) dolomitic limestone
  - 3) fluid lime
  - 4) pelletized lime
  - 5) ag-lime
- e) Be able to calculate the amount of liming material that should be applied to meet a soil test report recommended rate of lime.

### **3) Major Nutrients**

#### **a) Nitrogen**

- 1) understand the soil nitrogen cycle
- 2) understand how to select nitrogen fertilizer sources for agronomic efficiency and for maintaining environmental quality
- 3) recognize how soil physical properties affect nitrogen fertilization
- 4) recognize how cropping and tillage systems affect nitrogen fertilization

#### **b) Phosphorus**

- 1) recognize the advantages and disadvantages of different phosphorus application methods and sources
- 2) recognize how cropping and tillage systems affect phosphorus fertilization
- 3) understand how to utilize best management practices (BMPs) to maximize agronomic efficiency and to minimize environmental impact

#### **c) Potassium**

- 1) recognize the advantages and disadvantages of different potassium application methods and sources
- 2) recognize how cropping and tillage systems affect potassium fertilization

### **4) Secondary nutrient and micronutrients (with emphasis on sulfur, zinc, iron, boron & chloride)**

- a) Recognize the general deficiency and potential toxicity symptoms of the secondary nutrients and the micronutrient.
- b) Understand the methods of correcting secondary and micronutrient deficiencies.

### **5) Soil test reports and fertilizer recommendations**

- a) Understand use of soil test reports and calibration data to make economically and environmentally sound fertilizer recommendations
- b) Understand use of alternative nutrient sources such as animal waste, sludge or biosolids, legume crops and soil organic matter.

## 6) Nutrient sources

- a) Know the basic characteristics of common major nutrient materials such as:
  - 1) anhydrous ammonia (NH<sub>3</sub>)
  - 2) urea-ammonium nitrate solution
  - 3) ammonium nitrate
  - 4) urea
  - 5) diammonium phosphate (DAP)
  - 6) monoammonium phosphate (MAP)
  - 7) ammonium polyphosphate solution (APP)
  - 8) potassium chloride (KCl)
- b) Know the basic characteristics of common secondary and micronutrient materials

## 7) Soil amendments

- a) Know characteristics of material used as amendments for saline and sodic soils
- b) Evaluate non-traditional products for use in Kansas

## 8) Equipment Calibration (WQP)

- a) Know the importance of and procedures to calibrate nutrient application equipment, including fertilizer spreaders, manure/sludge applicators and others.

## 9) Waste Management (WQP)

- a) *Know how to calculate total annual waste produced by an animal feeding operation.*
- b) *Have a working knowledge of the interaction of production, environmental and management factors for determining the capacity of storage needed by an animal feeding operation.*
- c) *Know how to calculate manure storage capacities for various storage options.*
- d) *Recognize the effect on plant nutrient availability and on the potential environmental impact from various aspects of waste management, including:*
  - 1) *Animal Species*
  - 2) *Laboratory analysis vs. average nutrient values*
  - 3) *Rate of waste application*
  - 4) *Timing of waste application*
  - 5) *method of waste application, including:*
    - (a) *incorporation*
    - (b) *surface broadcast,*
    - (c) *injection*
    - (d) *irrigation*

- e) *Distinguish between total content, plant nutrient availability and plant residual value for:*
- 1) *Nitrogen*
  - 2) *Phosphorus*
  - 3) *Potassium*
  - 4) *Micronutrients*
  - 5) *Heavy Metals*
- f) *Understand how various soil characteristics and climatic factors influence waste management, nutrient utilization, and potential losses.*
- 1) *Slope*
  - 2) *Plant species and growth habit*
  - 3) *Volatilization*
  - 4) *Leaching*
  - 5) *Plant rooting depth*
  - 6) *Ground and surface water*
  - 7) *Surface run-off*
  - 8) *Residue cover*
  - 9) *Flooding*
  - 10) *Soil texture*
  - 11) *Frozen soil and snow cover*
  - 12) *Salinity*
  - 13) *pH*
- g) *Know how to take an accurate and representative sample for each of the major waste handling methods.*
- h) *Understand the major types of waste collection, handling and storage systems and the safety procedures involved with each system.*
- i) *Recognize various application methods and equipment. Understand their potential impact on:*
- 1) *Labor/Seasonal workforce*
  - 2) *Equipment*
  - 3) *Energy*
  - 4) *Nutrient availability*
  - 5) *Capital*
  - 6) *Environmental factors*
  - 7) *Crop and harvest management*
- j) *Understand the economic value (cost; benefit) of waste nutrients compared to other nutrient sources..*
- k) *Recognize management methods to reduce manure waste odors.*
- l) *Understand human pathogen occurrence in livestock manure.*

- m) Understand management practices to reduce risk of pathogen introductions, reduce on-farm amplification, and reduce pathogen transport to surface water.*

#### **10) Elements of Nutrient Management Planning (WQP)**

- a) Understand and identify the elements of a Comprehensive Nutrient Management Plan (CNMP)*
- b) Have the ability to write the nutrient management component (Permit Nutrient Plan, PNP) of a CNMP.*
- c) Knowledge of Kansas laws for storage, transport and application of waste.*

#### **11) Nutrient Import and Export (WQP)**

- a) Know the source of nutrients and pollutants that enter and leave farms and livestock operations.*
- b) Recognize management options to reduce nutrient surplus on farms and livestock operations.*
- c) Recognize the nutrient-concentrating nature of Kansas livestock production.*
- d) Know how to calculate the mass nutrient balance and the nutrient budget for a livestock farm or an animal feeding operation.*
- e) Understand management strategies that can reduce imported nutrients, reduce exported nutrients, and improve the efficiency of nutrient cycling on livestock farms and animal feeding operations.*

## **SOIL AND WATER MANAGEMENT COMPETENCY AREAS:**

1. Basic physical properties of soil
2. Soil water management
3. Soil conservation
4. Irrigation management
5. Managing for water quality
6. *Soil Hydrology (WQP)*
7. *Drainage (WQP)*
8. *Watershed Hydrology (WQP)*
9. *Ground Water Hydrology (WQP)*
10. *Critical Management Zones (WQP)*
11. *Agricultural Non-Point Source (NPS) Pollution Control (WQP)*
12. *Point and Non-Point Source Pollution (WQP)*

## **EXPERTISE WITHIN EACH COMPETENCY AREA:**

### **1) Basic physical properties of soil**

a) Recognize effects of soil physical properties on:

- 1) water holding capacity
- 2) water intake
- 3) internal soil drainage
- 4) soil tilth
- 5) compaction
- 6) root growth

### **2) Soil water management**

a) Understand how cropping systems and tillage practices affect water storage availability for plant use.

### **3) Soil conservation**

a) Understand factors important in controlling wind and water erosion, such as:

- 1) residue cover and management
- 2) conservation systems
- 3) length and grade of slope
- 4) soil characteristics
- 5) rainfall characteristics
- 6) crop characteristics
- 7) tillage
- 8) unsheltered distance
- 9) critical wind erosion period



b) Understand how these factors affect runoff and leaching:

- 1) residue cover and management
- 2) conservation systems
- 3) length and grade of slope
- 4) soil characteristics
- 5) rainfall characteristics
- 6) crop characteristics
- 7) tillage

c) Be able to estimate residue cover

#### **4) Irrigation management**

a) Understand how the following factors affect water efficiency, infiltration and runoff:

- 1) weather
  - (a) precipitation
  - (b) temperature
  - (c) season
  - (d) crop residue
- 2) soil factors
  - (a) texture
  - (b) slope
  - (c) compaction
  - (d) soil amendments
- 3) irrigation system type
  - (a) sprinkler
  - (b) gravity/furrow
  - (c) drip
- 4) crop management
  - (a) tillage
  - (b) residue
  - (c) cropping system

b) Understand how the following factors affect crop water use:

- 1) temperature
- 2) wind
- 3) solar radiation
- 4) relative humidity
- 5) crop growth state (plant canopy, rooting depth, etc.)
- 6) soil factors (texture, compaction, etc.)

c) Understand basic differences between irrigation system types:

- 1) gravity/furrow
  - (a) conventional
  - (b) surge flow
- 2) sprinkler
  - (a) center pivot (conventional, low pressure, LEPA (Low energy precision application), etc.)
  - (b) solid set sprinkler
  - (c) towable
- 3) drip (buried or surface)

d) Identify critical water use periods for different crops and the effect of water stress on growth and yield.

e) Understand the relationship between available water holding capacity and soil texture.

f) Understand how irrigation water supply and irrigation well output affect crop selection and crop management.

g) Be able to calculate crop water use and irrigation output.

h) Understand how to use management techniques and weather information to schedule and manage irrigation. Examples include:

- 1) "feel" method
- 2) gypsum blocks
- 3) tensiometer
- 4) checkbook method
- 5) computer models

i) Understand and define the following terms:

- 1) evapotranspiration
- 2) available water holding capacity
- 3) field capacity
- 4) wilting point
- 5) consumptive use or crop water use
- 6) potential evapotranspiration (PET)
- 7) chemigation (including application of pesticides and fertilizers)
- 8) water use efficiency
- 9) leaching
- 10) effective root zone

- j) Identify and understand how irrigation water quality affects crop and soil management.
- 1) effect of total salinity concentration on crop growth and yield
  - 2) effect of excess sodium on soil characteristics
  - 3) effect of dissolved ions on potential plant toxicity, such as chloride (Cl), nitrate (NO<sub>3</sub>), sulfate (SO<sub>4</sub>), boron (B), etc.
  - 4) understand reclamation methods and methods for managing saline and sodic soils
- k) Have an awareness of state and national rules and regulations for irrigation water quality and use including:
- 1) application of nutrients, waste and pesticides through irrigation systems
  - 2) system calibration for nutrient, waste and pesticide application
  - 3) water use limitations and restrictions

## **5) Managing for water quality**

- a) Have an awareness of state and national rules and regulations concerning:
- 1) pesticide management areas (PMAs)
  - 2) wildlife management areas
  - 3) wellhead protection areas
  - 4) ground water management areas
  - 5) nutrient management plans
  - 6) best management practices (BMPs)
  - 7) Total Maximum Daily Loads (TMDLs)

## **6) Soil Hydrology (WQP)**

- a) *Know the basic components of the hydrologic cycle.*
- b) *Describe the water budget for a soil profile and understand factors that affect:*
- 1) *Soil infiltration*
  - 2) *Evaporation and transpiration*
  - 3) *Leaching*
  - 4) *Runoff*
  - 5) *Storage*
- c) *Know the relationship between soil water content, soil water tension and soil pore size and qualitatively understand how these parameters vary for different soil types and their relation to plant growth*
- 1) *Field capacity*
  - 2) *Permanent wilting point*
  - 3) *Available water capacity*
  - 4) *Total soil water storage capacity*
  - 5) *Drainable porosity*
  - 6) *Soil texture, structure*
  - 7) *Macroporosity/Preferential flow*

- d) Understand the relation between soil type and hydraulic conductivity. Understand how this relationship affects water movement through the soil profile.*
- e) Understand how seasonal soil conditions, weather, crop management, and landscape position affect runoff and leaching.*

## **7) Drainage (WQP)**

- a) Identify the NRCS hydrologic class for a given soil type and explain the significance to productivity, nutrient availability, and nutrient loss.*
- b) Know the advantages and disadvantages of surface and subsurface drainage systems.*
- c) Understand the potential impacts of the following factors affecting drainage systems:*
  - 1) Location and depth of bedrock*
  - 2) Soil gradation and porosity*
  - 3) Topography*
  - 4) Organic soils*
  - 5) Type of crop*
  - 6) Outlet*
- d) Understand the benefits and risks to the environment that are potentially inherent to a drainage system.*

## **8) Watershed Hydrology (WQP)**

- a) Describe a watershed and its main functions.*
- b) Understand the major inputs and outputs of water in a watershed, including:*
  - 1) Precipitation*
  - 2) Storms*
  - 3) Infiltration and percolation*
  - 4) Storage (depression, channel, detention, ground water, retention, vegetation)*
  - 5) Base flow*
  - 6) Storm flow*
  - 7) Runoff (surface, channel, subsurface)*
  - 8) Evaporation*
  - 9) Transpiration*
  - 10) Recharge*
- c) Understand a stream hydrograph and its relation to pollution monitoring.*

- d) Explain the pollutant delivery process to surface water, and describe the relationship of nutrient budgets and total maximum daily loads (TMDL) to non-point source pollutant loading.*
- e) Define a 25-year, 24-hour event and list sources for identifying this event in Kansas*
- f) Describe the main agricultural point and non-point sources of contaminants in a typical rural watershed in Kansas*
- g) Understand key processes that occur in wetlands and their role in a watershed.*

## **9) Ground Water Hydrology (WQP)**

- a) Recognize some major concepts of ground water, including:
 
  - 1) aquifer*
  - 2) aquitard*
  - 3) vadose zone*
  - 4) saturated and unsaturated zones*
  - 5) recharge area*
  - 6) ground water gradient*
  - 7) effect of aquifer characteristics on ground water flow**
- b) Understand the relation between geologic conditions and the potential for ground water contamination.*
- c) Understand how water well construction, maintenance, and decommissioning affect ground water protection. Understand the concept of a direct entry pathway.*
- d) Understand the difference between a production well and a monitoring well. Understand how construction differences will affect the water quality and characteristics from each type of well.*

## **10) Critical Management Zones (WQP)**

- a) Understand and apply the concepts of hydrologically sensitive areas and critical management zones at the field, farm and watershed levels. Be able to give examples*
- b) Use a soil survey to locate a tract of land and to identify the soil type(s) and basic soil properties.*

- c) *Understand how to access and use sources of information for characterizing land application areas, including:*
  - 1) *soil survey*
  - 2) *Sensitive Ground Water Area delineation*
  - 3) *wetlands*
  - 4) *Wellhead Protection Areas*
  - 5) *setback distances from surface water and ground water supplies*
  - 6) *environmentally sensitive areas*
  - 7) *Critical Water Quality Management Area*
- d) *Identify some Best Management Practices (BMPs) that address water quality concern(s) in critical management zones on a field, farm, or watershed basis.*
- e) *Identify basic water quality indications and explain their significance.*
  - 1) *Chemical (nitrogen, phosphorus, pH, salinity, etc.)*
  - 2) *Physical (turbidity, total suspended solids)*
  - 3) *Microbiological (pathogens, biochemical oxygen demand, etc.)*
  - 4) *Biological (eutrophication, vegetation, etc.)*
- f) *Identify agencies, organizations, and references that will provide information on local, state and national watershed and ground water concerns.*

# **11) Agricultural Non-Point Source (NPS) Pollution Control (WQP)**

- a) *Describe the main sources of agricultural NPS pollution and their origins.*
  - 1) *Nutrients (especially nitrogen and phosphorus)*
  - 2) *Chemical (especially pesticides)*
  - 3) *Biological (especially pathogens and biochemical oxygen demand)*
  - 4) *Physical (especially sediment)*
- b) *Distinguish the difference between point source and non-point source pollution. Identify both agricultural and non-agricultural pollution sources. Understand the extent and importance of various sources in managing surface water and ground water quqlity.*
- c) *Understand the environmental impacts of various agricultural contaminants on the quality of surface and ground water as they relate to various uses, including:*
  - 1) *Domestic and potable water*
  - 2) *Recreational use*
  - 3) *Irrigation*
  - 4) *Industrial*

- d) Understand the concept of Best Management Practices for NPS pollution control.*
- e) Know some appropriate Best Management Practices for agricultural NPS pollution control in given production system.*
- f) Understand federal, state and local laws and regulations related to non-point source pollution control.*
- g) Know federal, state and local sources of technical and financial assistance to address agricultural NPS pollution.*

## PEST MANAGEMENT COMPETENCY AREAS:

1. Weed management
2. Plant disease management
3. Insect management
4. Integrated pest management
5. Pesticide use and safety
6. *Using Best Management Practices for water quality protection (WQP)*

## EXPERTISE WITHIN EACH COMPETENCY AREA:

### 1) Weed Management

- a) Weed biology: Understand the biology, interaction with crops and control of the following weeds within different cropping strategies:
- 1) barnyardgrass (*Echinochloa crus-galli*)
  - 2) Canada thistle (*Cirsium arvense*)
  - 3) cheat grasses (*Bromus* species)
  - 4) common cocklebur (*Xanthium strumarium*)
  - 5) fall panicum (*Panicum dichotomiflorum*)
  - 6) field bindweed (*Convolvulus arvensis*)
  - 7) field pennycress (*Thlaspi arvense*)
  - 8) foxtails (*Setaria* species)
  - 9) giant ragweed (*Ambrosia trifida*)
  - 10) hemp dogbane (*Apocynum cannabinum*)
  - 11) henbit (*Lamium amplexicaule*)
  - 12) ivyleaf morningglory (*Ipomoea hederacea*)
  - 13) johnsongrass (*Sorghum halepense*)
  - 14) jointed goatgrass (*Aegilops cylindrica*)
  - 15) kochia (*Kochia scoparia*)
  - 16) large crabgrass (*Digitaria sanguinalis*)
  - 17) musk thistle (*Carduus nutans*)
  - 18) mustards (*Brassica*, *Descurainia*, *erisimum*, and *Chorispora* species)
  - 19) Pennsylvania smartweed (*Polygonum pensylvanicum*)
  - 20) pigweed and waterhemp species (*Amaranthus* species)
  - 21) Russian thistle (*Salsola iberica*)
  - 22) sericea lespedeza (*Lespedeza cuineata*)
  - 23) shattercane (*Sorghum bicolor*)
  - 24) velvetleaf (*Abutilon theophrasti*)
  - 25) wild buckwheat (*Polygonum convolvulus*)
  - 26) yellow nutsedge (*Cyperus esculentus*)



## 2) Plant disease management

- a) Biology of plant diseases: Identify each of the following diseases by host plant systems, and classify each by crops infected and type of casual organism:
- 1) *Anthracnose* (corn) (*Collectotrichum graminicola*)
  - 2) barley yellow dwarf (luteovirus group)
  - 3) charcoal rot (all crops) (*Macrophomina phaseolina*)
  - 4) *Fusarium* stalk rots (corn and sorghum) (*Fusarium* species)
  - 5) gray leaf spot (corn) (*Cercospora zeae-maydis*)
  - 6) *Pythium* seedling rot (all crops) (*Pythium* species)
  - 7) *Phytophthora* root rot (soybeans and alfalfa) (*Phytophthora* species)
  - 8) *Rhizopus* head rot (sunflower) (*Rhizopus arrhizus* or *R. stolonifera*)
  - 9) rust (all crops) (*Puccinia* and *Uromyces* species)
  - 10) sooty stripe (sorghum) (*Ramulispora sorghi*)
  - 11) soybean cyst nematode (*Heterodera glycine*)
  - 12) take-all (wheat) (*Gaeumannomyces graminis*)
  - 13) tan spot (*Pyrenophora tritii-repentis*)
  - 14) wheat streak mosaic (Potyvirus group)

## 3) Insect management

- a) Insect biology: Identify the dispersing and damaging stages of the following pests; classifying them by feed habits, crops attacked, type of metamorphosis and predominant management strategies employed:
- 1) alfalfa weevil (*Hypera postica* (Gyllenhal))
  - 2) aphids
    - (a) pea aphid (*Acyrtosiphon pisum* (Harris))
    - (b) blue alfalfa aphid (*Acyrtosiphon kondoi* Shinji)
    - (c) spotted alfalfa aphid (*Therioaphis maculata* (Bucton))
  - 3) armyworm (*Pseudaletia unipuncta* (Haworth))
  - 4) black cutworm (*Agrotis ipsilon* (Hufnagel))
  - 5) blister beetle (*Epicauta* spp.)
  - 6) cereal leaf beetle (*Oulema melanopus* (Linnaeus))
  - 7) chinch bugs (*Blissus leucopterus leucopterus* (Say))
  - 8) corn earworm (*Helicoverpa zea* (Boddie))
  - 9) corn flea beetle (*Chaetocnema pulicaria* Melsheimer)
  - 10) corn rootworm (*Diabrotica* spp.)
    - (a) Western corn rootworm (*Diabrotica virgifera virgifera* LeConte)
    - (b) Northern corn rootworm (*Diabrotica barberi* Smith & Lawrence)
    - (c) Southern rootworm (*Diabrotica undecimpunctata howardi* Barber)
  - 11) *Dectes* stem borer (*Dectes texanus texanus* LeConte)
  - 12) European corn borer (*Ostrinia nubilalis* (Hubner))
  - 13) fall armyworm (*Spodoptera frugiperda* (J.E. Smith))
  - 14) grasshopper (*Melanopus* spp.)
  - 15) greenbug (*Schizaphis graminum* (Rondani))
  - 16) Hessian fly (*Mayetiola destructor* (Say))
  - 17) potato leafhopper (*Empoasca fabae* (Harris))

- 18) Russian wheat aphid (Mordvilko))
- 19) spider mites
  - (a) Banks grass mite (*Oligonychus pratensis* (Banks))
  - (b) two-spotted spider mite (*Tetranychus urticae* Koch)
- 20) southwestern corn borer (*Diatraea grandiosella* Dyar)
- 21) stored grain insect complex
- 22) sunflower head clipper weevil (*Haplorhynchites aeneus* (Boheman))
- 23) sunflower head moth ( *Homoeosoma electellum* (Hulst))
- 24) sunflower seed weevil (*Bruchidae* spp.)
- 25) sunflower stem weevil *Cylindrocopturus adspersus* (LeConte))
- 26) Western bean cutworm (*Richia albicosta* (Smith)
- 27) white grubs (*Cyclocephala* spp.)
- 28) wireworm (*Elateridae*)

#### **4) Integrated pest management**

- a) Make economically and environmentally sound pest management recommendations for a specific site or situation.
- b) Understand the relationship between pest management practices and development of pest resistance.
- c) Recognize the need for following up to verify that pest management intervention strategies have had the desired effect.

#### **5) Pesticide use and safety**

- a) Understand pesticide labels and labeling
- b) Exhibit competency in pesticide record keeping
- c) Demonstrate an awareness of worker protection laws (notification, protective gear, and re-entry)

#### **6) Using Best Management Practices for water quality protection (WQP)**

- a) *Pesticide Movement in soil and water.*
  - 1) *Recognize how movement of a pesticide in soil or into water may be affected by:*
    - (a) *Soil texture*
    - (b) *Erosion*
    - (c) *Pesticide persistence and degradation processes*
    - (d) *Leaching*
    - (e) *Precipitation and irrigation runoff*
    - (f) *Pesticide solubility*
    - (g) *Pesticide absorption*
    - (h) *Source of entry into the environment*

- 2) *Understand soil/pesticide interactions and their influence on pesticide selection, pesticide use, BMPs, and water quality protection.*
- 3) *Recognize how the following impact proper pesticide use in regard to water quality protection:*
  - (a) *Soil characteristics (chemical and physical)*
  - (b) *Residue cover and organic matter*
  - (c) *Proximity to water sources (surface water, ground water aquifers, water supply wells, etc.)*

*b) Government regulations*

- 1) *Recognize the general provisions of state pesticide regulation laws.*
- 2) *Recognize the general provision of recent EPA regulations such as the Clean Water Act and Worker Protection Standards.*

## **CROP PRODUCTION COMPETENCY AREAS:**

1. Crop growth and adaptation
2. Basic principles of forage production
3. Planting and seed management
4. Crop damage, mortality and factors influencing replanting decisions
5. Cropping systems
6. Site specific management

## **EXPERTISE WITHIN EACH COMPETENCY AREA:**

### **1) Crop growth and adaptation**

- a) Identify the life cycle and adaptation of crops commonly grown in Kansas, including, but not limited to:
  - 1) alfalfa
  - 2) corn
  - 3) cotton
  - 4) wheat
  - 5) cool season grasses, including
    - (a) smooth brome grass
    - (b) tall fescue
    - (c) western wheatgrass
  - 6) sorghum (grain and forage)
  - 7) soybean
  - 8) sunflower
  - 9) small grains and cereals, including:
    - (a) barley
    - (b) millet
    - (c) oats
    - (d) rye
    - (e) triticale
  - 10) clovers
  - 11) warm-season grasses (both native and introduced), including:
    - (a) bermudagrass
    - (b) bluestem
    - (c) buffalograss
    - (d) grama
    - (e) lovegrass
- b) Describe and use the staging systems to identify growth stages between emergence and physiological maturity for crops commonly grown in Kansas.
- c) Recognize relationships between the growth and development of major crops and management factors.

### **2) Basic principles of forage production**

- a) Describe how frequency of harvest is related to forage yield and quality.
- b) Describe how frequency and timing of harvest affects stand longevity, food reserves and stand persistence.
- c) Be able to distinguish between warm and cool season forages.
- d) Be able to distinguish between perennial and annual forages.

### **3) Planting and seeding management**

- a) Describe factors affecting seeding date of above crops.
- b) Describe environmental and cultural factors that influence the seeding rate.
- c) Describe factors influencing seeding depths.
- d) Hybrid/variety selection
- e) Seed quality

### **4) Crop damage, mortality and factors influencing replant decisions**

- a) Understand the effect of hail, frost, flooding, drought, insect, disease, and wind damage on crops listed above.
- b) Recognize when major Kansas crops are most susceptible to specific environmental stresses.
- c) Describe climatic and plant factors which influence a plant's ability to resume growth after being damaged.

### **5) Cropping systems**

- a) Understand the advantages and limitations of growing cover and companion crops.
- b) Compare and contrast single crop systems and crop rotations.
- c) Adaptation and use of biotechnology in cropping systems.
- d) Economic impact of crop management decisions.

## 6) Site specific management

- a) Understand concepts of "site specific" management ("precision farming"), including, but not limited to:
  - 1) Global positioning systems (GPS)
  - 2) Geographic information systems (GIS)
  - 3) Grid sampling
  - 4) Variable rate technology
  - 5) Monitoring technology
  - 6) Field mapping

