Arkansas/Louisiana/Mississippi Regional Certified Crop Advisor Performance Objectives

2017 (Revision)

Regional CCA Exam Committee

John Fontane, Louisiana CCA

Clint Jayroe, Arkansas CCA

Larry Oldham, Mississippi State University

Dennis B. Reginelli Mississippi State University

Johnny Saichuk, Louisiana CCA

Nathan Slaton, University of Arkansas System Division of Agriculture

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Forward

Agriculture in Arkansas, Louisiana, and Mississippi encompasses a number of crops and production systems and requires a broad knowledge of agronomic principles, pest management, irrigation, soil and fertilizer nutrient management, and the interaction among these disciplines. The major crops grown in each of these states is listed in the table below. While the exact management practices used to produce each of these crops may differ from state to state, the fundamentals of crop management are based on a common set of scientific principles that are outlined in the international performance objectives. The local performance objectives outlined in the following document do not repeat the international performance objectives, but provide situations that relate specifically to the most common agricultural crops and production systems used in the mid-South. The AR/LA/MS performance objectives will be periodically reviewed and revised. Constructive feedback regarding the AR/LA/MS performance objectives is welcome and can be directed to the performance objective and exam committee members listed on the previous page.

	State†			
Crop	Arkansas	Louisiana	Mississippi	3-State Total
	Planted Acres (in 2012)			
Corn	760,000	620,000	750,000	2,130,000
Cotton	380,000	140,000	435,000	955,000
Forage, All Hay	1,204,000	380,000	640,000	2,224,000
Grain sorghum	470,000	52,000	13,000	535,000
Peanut	24,000	0	39,000	63,000
Rice	1,546,000	437,000	195,000	2,178,000
Soybean	3,130,000	1,230,000	2,040,000	6,400,000
Sugarcane‡	0	400,000	0	400,000
Winter wheat	195,000	25,000	285,000	1,205,000

† Statistics from https://quickstats.nass.usda.gov/. Peanut and other crops like sesame, sunflower, and number of horticultural (fruits and vegetables) crops are also grown in these states.

‡ Sugarcane acres harvested.

AR/LA/MS REGIONAL CERTIFIED CROP ADVISER

PERFORMANCE OBJECTIVES

2017

I. Soil Fertility Assessment, Plant Nutrition & Nutrient Management

Competency Area 1. Fundamentals of Soil Fertility and Plant Nutrition

1. Explain how land leveling practices influence nutrient stratification and soil-test results.
2. Explain how to soil sample fields used for irrigated crop production to identify fertility gradients caused by water quality.
3. Describe how soil texture and organic matter influence nutrient availability and CEC.
4. List the most common nutrient deficiencies, their symptoms and the typical growth stage and location (e.g., top or bottom leaves) on crops grown in the mid-South USA.
5. Calculate dry and liquid fertilizer nutrient rates using a product label, soil-test report, or both.

Competency Area 2. Soil pH, Liming, and Salinity

1. Describe how soil pH influences the availability of essential and non-essential nutrients that are commonly deficient or toxic to crops grown in the mid-South.
2. Describe the effect of flood irrigation for rice production on soil pH (e.g., how pH changes during flooding and after flood removal).
3. Explain how lime application time in regards to crop rotation sequence (e.g., rice – soybean rotation) and post-application management (e.g., incorporation) influence lime reaction and crop response to liming.
4. Define soil pH and the different types of pH (water, salt, and buffer) that might be listed on a soil-test report.
5. Explain how field and weather conditions cause soil pH and salinity to fluctuate during the year.
6. Explain how the soil:water ratio influences soil salinity measurement (electrical conductivity) and interpretation.
7. Know the optimal soil pH range for crops commonly grown in the mid-South.
8. Explain how irrigation water source and quality influences the need for lime.
9. Explain the differences between lime sources (calcitic and dolomitic) and forms (ag lime and pelletized lime).
10. Explain the soil factors, lime properties, and testing methods used to determine lime rate.

Competency Area 3. Nitrogen

1. Explain how short- (flushing a rice field) and long-term (flooding a rice field) flood irrigation influences the N transformation and loss processes in the N cycle. Understand the relative rate (e.g., speed) of each N process in the N cycle and indicate how temperature and soil moisture influence the reaction rate.
2. List the common commercial N-fertilizer sources, their properties, and their reactions with soil after application that make them appropriate or inappropriate for use in specific cropping systems.
3. Explain 4R management practices that minimize N loss and aid in efficient plant uptake of common N fertilizers for crop production systems common to the mid-South including:
    a. application time,
    b. soil conditions,
    c. application method,
    d. irrigation timing.
4. Explain how soil texture usually influences crop N requirement.
5. Explain the N availability of poultry litter including its N release rate and how this influences the N credit given toward a crops N recommendation.
6. Explain the N loss pathways, N transformations, and field/environment conditions that urease and nitrification inhibitors influence in mid-South irrigated cropping systems.
7. Explain how soil moisture and temperature influence the N release rate from polymer-coated fertilizers like ESN and what mid-South cropping systems polymer-coated urea can be effectively used.
8. Calculate fertilizer rates given their N concentration and a N rate recommendation.
9. Explain how the desired legume-grass mixture influences forage N fertilization decisions.
10. List the processes involved in the N cycle and explain what factors influence each process.

Competency Area 4. Phosphorus

1. Explain how soil pH influences P availability.
2. Explain how alternate flooding-draining cycles (e.g., in crop rotation systems that include flood-irrigated rice or flooded-field habitat for waterfowl) influence soil and fertilizer P availability.
3. List the common commercial P-fertilizer sources, their properties, and their reactions with soil after application.
4. Explain 4R nutrient management practices that minimize P loss and aid in efficient plant P uptake for crop production systems common to the mid-South including:
    a. application time,
    b. soil conditions,
    c. application method,
    d. tillage.
5. Explain how soil buffering capacity (e.g., CEC) influences the rate of soil-test P build-up and depletion.
6. List the common soil-test P methods used in the mid-South:
    a. Mehlich III,
    b. Lancaster.
7. Calculate a crop P balance using crop P removal [estimates of crop yield and P content per unit of yield (e.g., bale or bushel)] and P inputs [fertilizer and manure P rates] to predict the short- and long-term response of P management on soil-test P (increase, no change or decrease).

Competency Area 5. Potassium

1. Explain how soil pH and the abundance of other soil cations influences exchangeable K retention in soil.
2. List the common commercial K-fertilizer sources, their properties, and their reactions with soil after application.

3. Explain 4R management practices that minimize K loss and aid in efficient plant K uptake for crop production systems common to the mid-South including:
    a. application time,
    b. soil conditions,
    c. application method,
    d. tillage.
4. Explain how soil buffering capacity (e.g., CEC) and soil-test K influence the rate of soil-test K build-up and depletion.
5. Calculate a crop K balance using crop K removal [estimates of crop yield and K content per unit of yield (e.g., bale or bushel)] and K inputs [fertilizer and manure K rates] to predict the short- and long-term response of K management on soil-test K (increase, no change or decrease).

Competency Area 6. Secondary and Micronutrients

1. List the common commercial secondary and micronutrient fertilizer sources, their properties, and their reactions with soil after application.
2. Explain how soil pH influences the availability of soil micronutrients.
3. List the most common micronutrient deficiencies and toxicities by crop that occur in the mid-South.
4. Calculate secondary and micronutrient fertilizer rates given their fertilizer nutrient concentration and a rate recommendation.
5. Explain the meaning of water-soluble nutrient content listed on a micronutrient fertilizer label.
6. List the different methods (e.g., soil, in-furrow, foliar, seed, etc.) of micronutrient fertilization for Zn, B and Mo and describe the pros and cons of each method.
7. Define grass tetany (hypomagnesemia) and explain the practices that can accentuate or prevent this problem.

Competency Area 7. Soil sampling and analysis

1. List the most common units (ppm vs lbs/acre) used on soil-test reports and explain their relationship.

2. Define the general meaning of soil-test level (e.g., Low, Medium, High, Very High, Optimum, etc.) as it relates to the expected agronomic yield response to fertilization (probability and magnitude of response).
3. Explain how to properly collect composite soil samples for zone, grid and field-average based fertilization practices to minimize temporal variability and obtain repeatable and accurate results.
4. Explain how crop residues and environmental conditions (temperature and moisture) may influence temporal variability in soil-test results (e.g., pH, P, K, etc.).
5. Explain how nutrient mobility in the soil influences the recommended soil sample depth.
6. Interpret a soil-test report using published tables that list soil-test levels and fertilizer rate recommendations.

Competency Area 8. Plant Sampling and analysis

1. Calculate plant nutrient content given a nutrient concentration and biomass (dry matter or yield) information.
2. Use plant tissue analysis and a table of critical nutrient concentrations to identify a nutrient deficiency or toxicity.

Competency Area 9. Manure nutrient management and analysis

1. Calculate manure rates given their N, P (or P_2O_5), K (or K_2O), S, etc. concentrations and nutrient rate recommendations from manure analysis results.
2. Define what a nutrient availability coefficient is and list N, P, and K availability coefficients for common animal manure sources.
3. Interpret a manure analysis report and use the information to include the manure as part of a farm's nutrient management plan.
4. Define the benefits of the use of "poultry litter" as a soil amendment and under what conditions is it likely to be of benefit.

II. Soil and Water Management

Competency Area 1. Soil physical properties

1. Explain how soil texture influences bulk density and soil pore space.
2. List typical soil bulk density values for sandy-, loamy-, and clayey-textured soils.
3. Explain how to generalize soil texture from soil-test information (e.g., from CEC).

Competency Area 2. Soil taxonomy and use of soil survey information

1. Know how to use soil survey and soil taxonomic name information to identify useful information for soil and crop management including:
    a. physical and chemical properties associated with a soil series,
    b. soil classifications that are useful, e.g., identify soils that have a natric horizon that might be problematic for land leveling,
    c. estimate how soil texture changes with profile depth,
    d. limitations of a soil series,
    e. erosion.

Competency Area 3. Fundamentals of irrigation management

1. Read a flow meter gauge to determine flow rate and gallons of water pumped.
2. List the recommended minimum pumping capacity (gallons per minute/acre) of an irrigation unit for specific soil conditions including hard pans and soil texture.
3. Calculate the time required to flood a rice field given pump flow rate, field acreage, and total water amount (acre inches) needed to establish a flood.
4. Explain the crop growth stages that irrigation is initiated and terminated for irrigated crops common to the mid-South.
5. List the crop growth stages considered most sensitive to drought stress.
6. Explain the crop growth stages at which maximum daily water use occur.
7. List examples of crop maximum daily water use in the mid-South.
8. Explain how precision grading a field enhances irrigation water management.
9. Explain the pros and cons of precision grading a field to zero-slope vs a consistent slope (0.1 ft/100 ft).
10. List the recommended allowable water deficits by crop that may be used to initiate irrigation.

11. List the average total irrigation water requirement (acre-inches/year) for crops common to the mid-South.
12. List and define the different crop irrigation methods including flood, furrow, border, and multiple-inlet irrigation systems.
13. Describe how irrigation water management interacts with other crop management areas (e.g., fertilization and pest management).
14. Explain how winter flooding of fields (e.g., for waterfowl habitat or natural flooding events) influences soil and fertilizer nutrient availability.

Competency Area 4. Irrigation Water Quality Assessment

1. Identify the critical calcium (Ca), chloride (Cl), bicarbonate (HCO_3), electrical conductivity (EC), and sodium adsorption ratio (SAR) concentration/values of irrigation water.
2. Know concerns each water quality property causes when the critical value is exceeded.

Competency Area 5. Surface and Groundwater Quality and Nutrient Management

1. Define water quality (chemical, physical and biological aspects), watershed, point source pollution, and non-point source pollution as they relate to both agricultural and urban activities.
2. Understand what a watershed is and how watersheds are managed to minimize surface and groundwater issues.
3. Discuss how a water body's designated use and potential impairments influence water quality determinations as established in the Clean Water Act.
4. Describe how risk assessment indices such as the Phosphorus Index work to improve water quality and prevent water degradation.
5. Identify issues with runoff of nitrogen and phosphorus to adjacent surface water bodies.

III. Pest Management

Competency Area 1. Weed identification and control

1. Be able to identify, either visually or by description, seedling through mature development stages of the weeds listed in the table below and be able to describe and identify the weeds using their morphological structures. Pest Management Table 1

Grassy Weeds	Broadleaf Weeds	Aquatics & Sedges	Weeds toxic to livestock
Annual bluegrass	Buttercup	Alligatorweed	Cocklebur
Barnyardgrass*	Chickweed	Arrowhead	Horsenettle
Broadleaf Signalgrass	Cocklebur	Dayflower (Spreading)	Jimsonweed
Crabgrass spp.	Groundcherry, cutleaf	Ducksalad	Johnsongrass
Fall panicum	Henbit	Eclipta	Milkweed
Goosegrass	Hemp Sesbania	Purple Nutsedge	Perilla Mint
Italian Ryegrass*	Horsenettle	Redstem (Ammania)	Pokeweed
Johnsongrass*	Horseweed	Rice Flatsedge	Sicklepod
Red Rice*	Morningglory, pitted	Roundleaf mudplantain	
Sprangletop, tighthead	Morningglory, palmleaf	Umbrella sedge	
Sprangletop, loosehead	Morningglory, entireleaf	Yellow Nutsedge	
	Morningglory, ivyleaf		
	Northern Jointvetch		
	Palmer Amaranth*		
	Prickley sida		
	Ragweed, Common		
	Ragweed, Giant		
	Redroot pigweed		
	Sicklepod		
	Smartweed spp		
	Velvetleaf		
	Wild garlic		
	Wild onion		

* Indicates weed has documented resistance to at least one herbicide family. Additional information on herbicide resistance weeds can be found at the website http://www.weedscience.org/Summary/Country.aspx.

2. List and identify weeds that can be toxic to livestock.
3. Recommend cultural and chemical practices using published informaton (e.g., weed control ratings), weed growth characteristics, and field scenarios (e.g., field environment, crop and weed growth stages, timing, weeds present, etc.).
4. Explain the difference between contact and residual herbicides.

5. Define pre-emerge, delayed pre-emerge, and post-emergence as they relate to herbicide application time.

Competency Area 2. Disease identification and control

1. Be able to identify, either visually or by description, symptoms of crop diseases listed in the table below and be able to describe the crops, conditions and losses associated with each disease. Pest Management Table 2

Corn/Grain Sorghum	**Cotton**	**Rice**	**Soybean**	**Winter Wheat**
Seedling diseases*	Seedling diseases*	Seedling diseases*	Seedling diseases*	Bacterial Streak
Anthracnose (various)	Boll rots	Bacterial Panicle Blight	Aerial Blight	Barley Yellow Dwarf Virus
Aspergillus Ear Rot	Fusarium Wilt	Blast	Anthracnose	Downy Mildew (Crazy Top)
Charcoal Rot	Reniform Nematodes	Brown Leaf Spot	Brown Spot	Fusarium Head Blight (Scab)
Common Rust	Root-knot Nematodes	False Smut	Cercospora Leaf Blight and Purple Seed Stain	Glume Blotch
Downy Mildew (Crazy Top)	Target Spot	Kernel Smut	Charcoal Rot	Leaf Rust
Gray Leaf Spot	Verticullum Wilt	Narrow Brown Leaf Spot	Frogeye Leaf Spot	Powdery Mildew
Northern Leaf Blight		Sheath Blight	Downy Mildew	Septoria Tritici Blotch
Smut (various)		Straighthead	Phytophtora Root Rot	Sooty Mold
Southern Leaf Blight		Stem Rot	Reniform Nematode	Stem Rust
Southern Rust			Root-knot Nematode	Stripe Rust
Stalk rots (various)			Southern Blight	Take-all
Target Spot (Grain Sorghum)			Soybean Cyst Nematode	Tan Spot
Zonate Leaf Spot (Grain Sorghum)			Soybean Rust	
			Stem Canker	
			Sudden Death Syndrome	
			Target Spot	

* Seedling diseases including (but not limited to) *Pythium* spp., *Rhizoctonia solani*, *Thielaviopsis basicola*, and several species of *Fusarium* as appropriate for each crop.

2. Recommend cultural and/or chemical control measures using published information (e.g., disease control ratings) and field scenarios (e.g., field environment, crop growth stages, timing, diseases present, etc.).
3. Describe aflotoxin in corn and its cultural and chemical control measures.
4. List and explain chemical and cultural control practices for nematodes.
5. List the crop growth stages where treatment for diseases is no longer needed.
6. Describe the difference between potassium deficiency in cotton and *Verticillium wilt*.

Competency Area 3. Insect identification and control

1. Be able to identify, either visually or by description, the multiple development stages of the insects listed in the table below and be able to describe each insect using its morphological features. Pest Management Table 3

Corn/Milo	Cotton	Rice	Soybean	Winter Wheat	Forages
Chinch Bugs	Aphids	Armyworms	Bean Leaf Beetles	Armyworms	Armyworms
Corn Borers	Beet Armyworm	Chinch Bugs	Beet Armyworm	Bird Cherry-oat Aphid	Blister Beetles
Corn Earworm	Boll Weevil	Grape Colaspis	Blister Beetles	Greenbugs (aphids)	Grasshoppers
Cutworms, including black cutworm	Brown Stink Bug	Rice Seed Midge	Brown Marmorated Stink Bug	Hessian Fly	Potato Leafhopper
Fall Armyworm	Cotton Aphid	Rice Stalk Borers	Brown Stink Bug		Red Imported Fire Ant
Sorghum Midge	Cotton Bollworm	Rice Stink Bug	Corn Earworm		

Table continued on next page

Corn/Milo	Cotton	Rice	Soybean	Winter Wheat	Forages
Southern Corn Rootworm	Cutworms	Rice Water Weevil	Fall Armyworms		
Stink Bugs	Fall Armyworm		Garden Webworm		
Sugarcane Aphid	Green Stink Bug		Grape Colaspis		
Wireworm	Loopers		Green Cloverworm		
	Plant Bugs		Green Stink Bug		
	Southern Green Stink Bug		Loopers		
	Spider Mites		Redbanded Stink Bug		
	Thrips		Red-shouldered Stink Bug		
	Whiteflies		Southern Green Stink Bug		
			Three-cornered Alfalfa Hopper		
			Velvetbean Caterpillar		
			Yellow-striped Armyworm		

2. Describe the insect growth cycle, type of crop damage and stages of crop susceptibility for each listed insect.
3. Recommend cultural and/or chemical control measures using published information (e.g., insect control ratings) and field scenarios (e.g., field environment, crop growth stages, timing, diseases present, etc.).

Competency Area 4. Fundamentals of pesticide use and pest scouting

1. Calibrate a sprayer given information on nozzle spacing, nozzle selection, travel speed, and spray rate.
2. Calculate the amount of a pesticide to mix in a sprayer given the spray rate, product label, and field size.
3. Describe the fundamental techniques and use of scouting tools (e.g., sweep nets, shake cloths, traps, etc.) for pest scouting in crops common to the mid-South.
4. Explain the steps in preventing, diagnosing and identifying pesticide movement (e.g., volatiliity, physical drift, runoff, etc.) and field misapplication.

Competency Area 5. Pesticide resistance management

1. List the factors that contribute to pest resistance to chemical control based on information provided (i.e., charts, tables) and field scenarios.
2. List pest resistance management strategies.
3. List diseases that are currently resistant to fungicides in the mid-South and explain control options and resistance management.
4. List weed species that are currently resistant to herbicides in the mid-South and explain control options and resistance management.
5. Describe the cultural and chemical control measures that can be used for effective pest control and management given scenarios and efficacy of control information.

Competency Area 6. Pollinator benefits and protection practices

1. List the crops grown in the mid-South USA that benefit from honeybee (and other pollinator) pollination assistance.
2. List crop and apiary management practices that minimize honeybee exposure to agricultural chemicals and discuss stewardship programs (e.g., Bee-aware flags) that aid in honeybee (and other pollinator) awareness and management.

IV. Crop Management

Competency Area 1. Fundamentals of crop establishment and management

1. Explain some of the major factors that should be considered in variety/cultivar/hybrid selection for major regional crops:
    a. Yield
    b. Disease ratings
    c. Maturity
    d. Herbicide technology
    e. Crop quality (fiber- cotton, milling- rice)
2. List the minimum and optimal soil temperatures recommended for seeding and germination of corn, cotton, grain sorghum, rice, soybean, and winter wheat.
3. Describe how planting date generally influences stand establishment, yield potential and other aspects of crop management.
4. Describe the categories and requirements for certified, registered, foundaton seed, and breeder seed.
5. Describe germination and accelarated aging (cotton and soybean).
6. Describe the advantages and disadvantages of different planting methods (e.g, flat-planting vs beds), row widths (e.g., drill, narrow, and wide rows) and tillage methods.
7. Describe how crop rotation practices influence pest management and fertility requirements.
8. Describe how to manage freeze damage in winter grain crops (e.g., winter wheat and oats).
9. Describe how to manage warm- and cool-season forages to mazimize yield and optimize forage qaulity parameters (e.g., crude protein (CP), total digestible nutrients (TDN), relative feed value (RFV), etc).
10. Explain and calculate seeding rates given information on seed size, desired stand, seed qaulity, and seeding rate adjustments.
11. Explain how modern technology (e.g., yield monitors, grid sampling, satellite imagery, etc.) can be used to aid crop management and assess crop performance.
12. Explain how crop yield and yield components respond to plant density.

Competency Area 2. Crop growth stages and development

1. List and define the growth stages for cotton:
    a. Describe boll setting by fruiting node and position for cotton.
    b. Describe the growth and development of cotton fiber (length, strength, micronaire, and uniformity).
    c. Define cutout for cotton (e.g., Node Above White Flower (NAWF) = 5).
    d. Describe harvest aid chemical types and list reasons why they are used: defoliation, growth inhibition, and boll opening.
    e. Describe how to determine when a cotton boll is mature.
    f. Describe the effects of temperature on defoliant activity.
2. List and define the growth stages for corn (for example VE through R stages, and recognition of physiological maturity).
3. Define the general growth stages and harvest management of warm season and cool season forages.
4. Describe the general growth stages for grain sorghum (for example pannicle initiation, flag leaf, and boot stage):
    a. Describe the use of harvest aides for grain sorghum.
5. List and define the growth stages for rice:
    a. Define growing degree days and explain how the DD50 for rice is used to predict crop growth stage (for example emergence, tillering, internode elongation (green ring), pannicle differentiation, booting, flowering, and grain development).
    b. Describe the use of harvest aides in rice.
6. List and define the growth stages for soybean (for example VE through R stages, and recognition of physiological maturity):
    a. Describe harvest aid chemical types and list reasons why they are used: defoliation, growth inhibition, and desiccation of weeds in soybeans.
    b. Describe soybean maturity groups and determinate and indeterminate growth habits.
7. List and define the growth stages for wheat (for example Feekes growth stages).

Competency Area 3. Fundamentals of crop breeding and genetics

1. Define a hybrid versus pure line cultivar.
2. Define outcrossing and explain why this is an important concern in red rice control in mid-South rice production systems.
3. Define the available herbicide-resistant crop production systems (for example, Clearfield, Roundup Ready, Liberty Link, Provisia, etc.) and know how crops with such technology are used in the mid-South.
4. Define available insect-resistant crop production systems (for example Bt cotton and corn) and know how crops with such technology are used in the mid-South.
5. Explain why hybrid seed should not be saved for planting the following year.
6. Define GMO.
7. List the crops that are considered to be GMOs and identify crop varieties that are considered GMOs.