Arkansas/Louisiana/Mississippi Regional Certified Crop Advisor Performance Objectives

2015 (Revision)

Regional CCA Exam Committee

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Foreword

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	710,000	540,000	820,000	2,070,000
Cotton	595,000	230,000	475,000	1,300,000
Forage, All Hay	1,450,000	460,000	750,000	2,660,000
Grain sorghum	31,000	130,000	52,000	213,000
Peanut	0	0	52,000	52,000
Rice	1,291,000	402,000	130,000	1,823,000
Soybean	3,200,000	1,130,000	1,830,000	6,160,000
Sugarcane	0	428,000	0	428,000
Winter wheat	550,000	285,000	370,000	1,205,000

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

AR/LA/MS REGIONAL CERTIFIED CROP ADVISER

PERFORMANCE OBJECTIVES

2015

I. Soil Fertility Assessment, Plant Nutrition & Nutrient Management

A. Fundamentals of Soil Fertility and Plant Nutrition

a. Explain how land leveling practices influence nutrient stratification and soil-test results.
b. Explain how to soil sample fields used for irrigated crop production to identify fertility gradients caused by water quality.
c. Describe how soil texture and organic matter influence nutrient availability and CEC.
d. 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.
e. Calculate dry and liquid fertilizer nutrient rates using a product label, soil-test report, or both.

B. Soil pH, Liming, and Salinity

a. 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.
b. Describe the effect of flood irrigation for rice production on soil pH (e.g., how pH changes during flooding and after flood removal).
c. 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.
d. Define soil pH and the different types of pH (water, salt, and buffer) that might be listed on a soil-test report.
e. Explain how field and weather conditions cause soil pH and salinity to fluctuate during the year.
f. Explain how the soil:water ratio influences soil salinity measurement (electrical conductivity) and interpretation.
g. Know the optimal soil pH range for crops commonly grown in the mid-South.
h. Explain how irrigation water source and quality influences the need for lime.
i. Explain the differences between lime sources (calcitic and dolomitic) and forms (ag lime and pelletized lime).
j. Explain the soil factors, lime properties, and testing methods used to determine lime rate.

C. Nitrogen

a. 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.
b. 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.
c. Explain management practices (e.g., application time, soil conditions, application method, irrigation timing, etc…) that minimize N loss and aid in efficient plant uptake of common N fertilizers for crop production systems common to the mid-South.
d. Explain how soil texture usually influences crop N requirement.
e. 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.
f. Explain the N loss pathways, N transformations, and field/environment conditions that urease and nitrification inhibitors influence in mid-South irrigated cropping systems.
g. 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.
h. Explain the sampling procedures (e.g., time of year and soil depth) for soil-N tests (soil NO_3-N and N-STaR) that are used to refine N-rate recommendations for specific crops
i. Calculate fertilizer rates given their N concentration and a N rate recommendation.
j. Explain how the desired legume-grass mixture influences forage N fertilization decisions.
k. List the processes involved in the N cycle and explain what factors influence each process.

D. Phosphorus

a. Explain how soil pH influences P availability.
b. Explain how alternate flooding-draining cycles (e.g., in crop rotation systems that include flood-irrigated rice or flooded-field habitat for waterfowl) influences soil and fertilizer P availability.

c. List the common commercial P-fertilizer sources, their properties, and their reactions with soil after application.
d. Explain management practices (e.g., application time, soil conditions, application method, tillage, etc…) that minimize P loss and aid in efficient plant P uptake for crop production systems common to the mid-South.
e. Explain how soil buffering capacity (e.g., CEC) influences the rate of soil-test P build-up and depletion.
f. List the common soil-test P methods used in the mid-South.
g. 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).

E. Potassium

a. Explain how soil pH and the abundance of other soil cations influences exchangeable K retention in soil.
b. List the common commercial K-fertilizer sources, their properties, and their reactions with soil after application.
c. Explain management practices (e.g., application time, soil conditions, application method, tillage, etc…) that minimize K loss and aid in efficient plant K uptake for crop production systems common to the mid-South.
d. Explain how soil buffering capacity (e.g., CEC) and soil-test K influences the rate of soil-test K build-up and depletion.
e. 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).

F. Secondary and Micronutrients

a. List the common commercial secondary and micronutrient fertilizer sources, their properties, and their reactions with soil after application.
b. Explain how soil pH influences the availability of soil micronutrients.

c. List the most common micronutrient deficiencies and toxicities by crop that occur in the mid-South.
d. Calculate secondary and micronutrient fertilizer rates given their fertilizer nutrient concentration and a rate recommendation.
e. Explain the meaning of water-soluble nutrient content listed on a fertilizer label.
f. 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.
g. Define grass tetany (hypomagnesemia) and explain the practices that can accentuate or prevent this problem.

G. Soil sampling and analysis

a. List the most common units (ppm vs lbs/acre) used on soil-test reports and explain their relationship.
b. Define the general meaning of soil-test level (e.g., Low, Medium, Optimum, etc…) as it relates to the expected agronomic yield response to fertilization (probability and magnitude of response).
c. 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.
d. Explain how crop residues and environmental conditions (temperature and moisture) may influence temporal variability in soil-test results (e.g., pH, P, K, etc…).
e. Explain how nutrient mobility in the soil influences the recommended soil sample depth.
f. Interpret a soil-test report using published tables that list soil-test levels and fertilizer rate recommendations.

H. Plant Sampling and analysis

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

I. Manure nutrient management and analysis

a. 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.

b. Define what a nutrient availability coefficient is and list N, P, and K availability coefficients for common animal manure sources.

c. Interpret a manure analysis report and use the information to include the manure as part of a farm's nutrient management plan.

d. 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

A. Soil physical properties

a. Explain how soil texture influences soil physical properties, e.g., bulk density and soil pore space.

b. List typical soil bulk density values for sandy-, loamy-, and clayey-textured soils and how to identify a generalized soil texture from soil-test information (e.g., from CEC).

c. Explain and be able to calculate plant available soil water, field capacity and permanent wilting point.

d. Explain mechanisms of erosion by wind and water and the effects on the landscape, e.g., soil and plants.

B. Soil taxonomy and use of soil survey information

a. Use soil survey and soil taxonomic name information to identify soil series' physical and chemical properties and classifications that are useful for soil and crop management. For example, identify soils that have a natric horizon that might be problematic for land leveling, estimate how soil texture changes with profile depth, or determine characteristic soil chemical properties associated with a soil series.

C. Fundamentals of irrigation management

a. Read a flow meter gauge to determine flow rate and gallons of water pumped.

b. List the recommended minimum pumping capacity (gallons per minute/acre) of an irrigation unit for specific soil conditions including hard pans and soil texture.

c. 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.

d. Explain the crop growth stages that irrigation is initiated and terminated for irrigated crops common to the mid-South.

e. List the crop growth stages considered most sensitive to drought stress.

f. Explain the crop growth stages at which maximum daily water use occur.

g. List examples of crop maximum daily water use in the mid-South.

h. Explain how precision grading a field enhances irrigation water management.

i. Explain the pros and cons of precision grading a field to zero-slope vs a consistent slope (0.1 ft/100 ft).

j. List the recommended allowable water deficits by crop that may be used to initiate irrigation.

k. List the average total irrigation water requirement (acre-inches/year) for crops common to the mid-South.

l. List and define the different crop irrigation methods including flood, furrow, border, and multiple-inlet irrigation systems.

m. Describe how irrigation water management interacts with other crop management areas (e.g., fertilization and pest management).

n. Explain how winter flooding of fields (e.g., for waterfowl habitat or natural flooding events) influences soil and fertilizer nutrient availability.

D. Water quality assessment

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

III. Pest Management

A. Weed identification and control

a. Identify seedling through mature stages, explain cultural and chemical control measures, and list treatment thresholds for grassy weeds common to the mid-South. Example grassy weeds include barnyardgrass, broadleaf signalgrass, cheat, crabgrass species, fall panicum, foxtail species, goosegrass, johnsongrass, little barley, red rice, sandbur, sprangletop species, and annual ryegrass.

b. Identify seedling through mature stages, explain cultural and chemical control measures, and list treatment thresholds for broadleaf weeds common to the mid-South. Example broadleaf weeds include bullthistle, cocklebur, groundcherry, hemp sesbania, horsenettle, horseweed, jointvetch species, lambsquarters, morningglory species, pigweed species including palmer amaranth, prickly sida, ragweed species, sicklepod, smartweed, velvetleaf, and wild garlic.

c. Identify seedling through mature stages of sedges and aquatic weeds common to the mid-South and explain recommended cultural and chemical control measures. Example sedges and aquatic weeds include ammania (redstem), arrowhead, dayflower, ducksalad, eclipta, rice flatsedge, and yellow nutsedge.

d. Identify seedling through mature stages, explain recommended cultural and chemical control mearures, and list treatment thresholds for winter weeds common to the mid-South. Example weeds include annual bluegrass, bitter sneezeweed, buttercup, carolina geranium, chickweed, cutleaf evening primrose, henbit, and mayweed.

e. List and identify weeds that can be toxic to livestock.

f. Explain the difference between contact and residual herbicides.

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

B. Disease identification and control

a. Identify symptoms, list the threshold for initiating control measures, and describe chemical and cultural control options for diseases common to corn and grain sorghum in the mid-South. Example diseases include anthracnose, corn leaf blight, gray leaf spot, and Southern rust.

b. Identify symptoms, list the threshold for initiating control measures, and describe chemical and cultural control options for diseases common to cotton in the mid-South. Example diseases include Fusarium wilt and Verticullum wilt.
c. Identify symptoms, list the threshold for initiating control measures, and describe chemical and cultural control options for diseases common to rice in the mid-South. Example diseases include bacterial panicle blight, blast, brown spot, false smut, kernel smut, sheath blight, stem rot, and straighthead (physiological disorder).
d. Identify symptoms, list the threshold for initiating control measures, and describe chemical and cultural control options for diseases common to soybean in the mid-South. Example diseases include aerial blight, asian rust, cercospora leaf blight/purple seed stain, damping off (pythium), charcoal rot, frogeye leaf spot, phytophthora root rot, stem canker, and sudden death syndrome.
e. Identify symptoms, list the threshold for initiating control measures, and describe chemical and cultural control options for diseases common to winter wheat in the mid-South. Example diseases include bacterial streak, Fusarium head blight, leaf rust, septoria leaf blotch, stripe rust, take-all, and tan spot.
f. Describe aflotoxin in corn and its cultural and chemical control measures.
g. Identify the symptoms of rootknot and reniform nematode damage in cotton and soybeans and soybean cyst nematode in soybeans.
h. List and explain chemical and cultural control practices for nematodes.
i. List the crop growth stages where treatment for diseases is no longer needed.
j. Describe the difference between potassium deficiency in cotton and *Verticillium wilt.*

C. Insect identification and control

a. Identify, list the threshold for initiating control measures, and describe chemical and cultural control options for insects common to corn in the mid-South. Example insects include Aphids (including Sugarcane Aphid), Chinch Bug, Corn Rootworm, Cutworm, European Corn Borer, Fall Armyworm, Southwestern Corn Borer, Sorghum Midge, and Stink Bugs.
b. Identify, list the threshold for initiating control measures, and describe chemical and cultural control options for insects common to cotton in the mid-South. Example insects include Aphids, Beet and Fall Armyworms, Boll Weevil, Cotton Bollworm, Tobacco

Budworms, Spider Mites, Plants Bugs, Soybean and Cabbage Loopers, Stink Bugs, and Thrips.

c. Identify, list the threshold for initiating control measures, and describe chemical and cultural control options for insects common to rice in the mid-South. Example insects include Grape Colapsis, Rice Stink Bug, Rice Water Weevil, and stem borers.
d. Identify, list the threshold for initiating control measures, and describe chemical and cultural control options for insects common to soybean in the mid-South. Example insects include Armyworms (Beet, Fall, and Yellow-striped), Blister Beetles, Grape Colapsis, and Stink Bugs.
e. Identify, list the threshold for initiating control measures, and describe chemical and cultural control options for insects common to wheat in the mid-South. Example insects include Armyworms, Aphids, Greenbugs, and Hessian Fly.

D. Fundamentals of pesticide use and pest scouting

a. Calibrate a sprayer given information on nozzle spacing, travel speed, and spray rate.
b. Calculate the amount of a pesticide to mix in a sprayer given the spray rate, product label, and field size.
c. Describe the fundamental techniques for pest scouting in crops common to the mid-South.
d. Explain the steps in preventing, diagnosing and identifying pesticide drift.

E. Pesticide resistance management

a. List the factors that contribute to pest resistance to chemical control.
b. List pest resistance management strategies.
c. List diseases that are currently resistant to fungicides in the mid-South and explain control options and resistance management.
d. List weed species that are currently resistant to herbicides in the mid-South and explain control options and resistance management.

IV. Crop Management

A. Fundementals of crop establishment and management

a. Explain the factors that should be considered in variety/cultivar/hybrid selection.
b. List the minimum soil temperatures recommended for seeding and germination of corn, cotton, grain sorghum, rice, soybean, and winter wheat.
c. Describe how planting date generally influences stand establishment, yield potential and other aspects of crop management.
d. Describe the categories and requirements for certified, registered, foundaton seed, and breeder seed.
e. Describe germination, accelerated aging and cool-test germination tests for seed.
f. 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.
g. Describe how crop rotation practices influence pest management and fertility requirements.
h. Describe how to manage freeze damage in winter grain crops (e.g., winter wheat and oats).
i. Describe how to manage warm- and cool-season forages to maximize yield and optimize forage quality parameters (e.g., crude protein (CP), total digestible nutrients (TDN), relative feed value (RFV), etc…).
j. Explain and calculate seeding rates given information on seed size, desired stand, seed quality, and seeding rate adjustments.
k. Explain how modern technology (e.g., yield monitors, grid sampling, satellite imagery, etc…) can be used to aid crop management and assess crop performance.
l. Explain how crop yield and yield components respond to plant density.

B. Crop growth stages and devlopment

a. List and define the growth stages for corn, cotton, forages, grain sorghum, rice, soybean, and wheat (Feekes stages).
b. Define growing degree days and explain how the DD50 for rice and DD60 for cotton are used to predict crop growth stage.
c. Describe boll setting by fruiting node and position for cotton.

d. Describe the growth and development of cotton fiber (length, strength, micronaire, and uniformity).
e. Define cutout for cotton (e.g., NAWF = 5).
f. Describe how to detemine when a cotton boll is mature.
g. Describe the maximum cotton moisture that cotton can be placed in a module.
h. Describe harvest aid chemical types and list reasons why they are used (defoliation, growth inhibition, desiccation, and boll opening).
i. Describe the effects of temperature on defoliant activity.
j. Describe soybean maturity groups and determinate and indetermiante growth habits.

C. Fundamentals of crop breeding and genetics

a. Define outcrossing and explain why this is an important concern in red rice control in mid-South rice production systems.
b. Define the available herbicide-resistant crop production systems (Clearfield, Roundy Ready, Liberty Link, etc…) and know how crops with such technology are used in the mid-South.
c. Explain why hybrid seed should not be saved for planting the following year.
d. List the crops that are considered to be GMOs and identify crop varieties that are considered GMOs.