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I. Nutrient Management

A. Basic principles of soil fertility and plant nutrition

1. Know the 16 elements essential for plant growth and the ionic form(s) by which

each is absorbed into plants.

Carbon	Sulfur	Phosphorous	Iron
Hydrogen	Boron	Potassium	Manganese
Oxygen	Chlorine	Calcium	Molybdenum
Nitrogen	Copper	Magnesium	Zinc

2. Cation exchange capacity (CEC)
    a. Be able to define CEC and understand how CEC is determined
    b. Understand the role CEC plays in plant nutrition
    c. Know the soil properties that affect CEC
    d. Understand the relationships among CEC, nutrient mobility, and nutrient availability.
3. Understand how soil, climatic, and nutrient properties affect movement and retention of nutrients in soil and water.
4. Understand how mineralization and immobilization affect nutrient availability.
5. Understand how site-specific management, geographic information system (GIS), global positioning system (GPS), grid soil sampling, yield mapping, variable rate technology (VRT), and remote sensing can be used in nutrient management.

B. Soil pH and liming
1. Define soil pH and understand the scale upon which pH is based.
2. Know the natural processes and agronomic practices that change soil pH.
3. Know the effect soil pH has on nutrient availability, elemental toxicity, and plant growth.
4. Understand the concept “Effective Neutralizing Material (ENM)” and how ENM is affected by lime material properties.
5. Know how crop production practices and soil properties affect lime requirements.
6. Understand the difference between water pH and salt pH (pH_s).
7. Know the desirable soil pH levels for crop growth and prevention of herbicide carry-over.
8. Understand the relationship between pH and aluminum toxicity.

C. Major nutrients
1. Nitrogen
    a. Understand the nitrogen cycle including the processes of : nitrification, mineralization, leaching, denitrification, volatilization, and nitrogen fixation.
    b. Recognize general N deficiency symptoms in leaves of grain and forage crops.
    c. Recognize the effects of soil properties, rate of nitrogen fertilization, availability of other nutrients, and environmental conditions on nitrogen uptake and nitrogen use efficiency by crops.
    d. Recognize how cropping systems affect the rate and placement of nitrogen fertilization.
    e. Know the analysis, physical form, and handling precautions of each of the following nitrogen fertilizer materials; anhydrous ammonia, urea, ammonium nitrate, UAN solutions, ammonium sulfate, ammonium thiosulfate.
    f. Know the advantages and disadvantages of each nitrogen fertilizer material

(see list in IC1e) in relation to soil series, cropping system, and tillage.

2. Phosphorus
    a. Recognize general phosphorus deficiency symptoms in grain and forage crops.
    b. Recognize how crop characteristics, soil properties, and crop management affect phosphorus fertilization requirements.
    c. Understand how soil pH, clay type, organic matter, and texture affect phosphorus retention and fixation.
    d. Recognize the analysis, physical form, and handling precautions of each of the following phosphorus fertilizer materials; diammonium phosphate, monoammonium phosphate, triple superphosphate ordinary superphosphate, ammonium phosphate (includes ammonium polyphosphates), rock phosphate.
    e. Know the advantages and disadvantages of each phosphorus fertilizer material (see list in IC2d) in relation to soil series, cropping system, placement, and tillage.
3. Potassium
    a. Recognize general potassium deficiency symptoms in grain and forage crops.
    b. Recognize how cropping systems and soil properties affect potassium fertilization requirements.
    c. Understand how CEC, clay type, and soil texture affect potassium retention, fixation, and availability.
    d. Recognize the analysis, physical form, and handling precautions of each of the following potassium fertilizer forms: potassium chloride, potassium sulfate, potassium nitrate.
4. Sulfur, calcium, and magnesium
    a. Recognize the general S deficiency symptoms in grain and forage crops.
    b. Understand the relationship between climatic conditions, organic matter, CEC, pH, and S availability.
    c. Recognize the analyses and characteristics of the following S materials: ammonium sulfate, elemental S, gypsum, magnesium sulfate.
    d. Understand how CEC, clay type, organic matter, and soil series influence Ca and Mg reactions and availability.
    e. Be able to describe the relationship between Ca, Mg, and crop problems such as grass tetany.
    f. Know how to select appropriate Ca and Mg sources including magnesium sulfate, gypsum, dolomitic limestone.

D. Micronutrients
    1. Recognize deficiency symptoms for the following micronutrients: zinc, manganese, iron, boron. Understand soil properties and nutrient interactions that affect availability of these mineral elements.
    2. Recognize toxicity symptoms for manganese and boron. Understand soil properties and nutrient interactions that affect availability of these mineral elements.
    3. Understand methods used to correct micronutrient deficiencies including foliar

and soil applications.

E. Nutrient management planning
   1. Know the elements of a nutrient management plan and how these elements fit together.
   2. Understand recommended soil sampling and handling procedures including: time of sampling, depth of sampling, frequency of sampling, and sampling density.
   3. Know recommended plant parts and stages of development for plant analysis of corn, soybean, grain sorghum, small grains, alfalfa and grass forages.
   4. Understand the principles of each of the following philosophies of soil test interpretation and recommendations: sufficiency; buildup and maintenance; and cation saturation ratio.
   5. Understand soil test and plant analysis reports and be able to make economically and environmentally sound nutrient application recommendations.
   6. Understand nutrient availability from organic nutrient sources such as animal wastes, sludges, legumes, soil organic matter, and cover crops, including proper sampling, sample handling, analysis, and interpretation procedures.
   7. Know calibration procedures for nutrient application equipment that will result in accurate and uniform applications of nutrients.
   8. Understand Missouri Department of Natural Resources regulations on manure and nutrient application rates.
   9. Know the factors to consider when selecting fields and crops most suitable for manure applications.
   10. Understand how the process of nutrient management planning protects water resources.

F. Environmental effects of nutrients
   1. Understand the process by which excess nutrients lead to eutrophication and other impacts on surface water quality.
   2. Know the importance of nutrients relative to other pollutants (organics, metals, sediment, pathogens) in different types of water bodies.
   3. Know best management practices (BMPs) to minimize movement of agricultural nutrients to surface and ground water resources.

II. Soil and Water Management

A. Soil surveys and landscapes
   1. Know how to use soil survey reports and maps and that they provide a resource inventory including: drainage classes, soil depth, soil slope, parent material, natural vegetation, and capability classes.
   2. Understand the relationship among soil series, soil map units, and landscape position.

B. Physical properties of soil
   1. Understand texture, bulk density, structure, and tilth.

2. Know and understand the meaning of available water, field capacity, wilting point and their relationship to soil physical properties.
3. Understand how soil physical properties influence land use, water holding capacity, water infiltration, internal drainage, air permeability, erosion potential, and root growth.
4. Understand how agronomic practices affect soil structure.
5. Recognize the effects of soil physical properties, plant cover, residue, and tillage on soil micro-climate including temperature, heat transfer, and moisture.
6. Soil compaction.
    a. Understand how soil compaction occurs and how compaction can be prevented or corrected.
    b. Know the relationship between soil physical properties and compaction potential.
    c. Recognize plant and soil symptoms of soil compaction and impermeable layers.

C. ab Soil biology
1. Define soil organic matter and humus.
2. Understand the relationship of organic matter to soil color, soil structure, and nutrient supply.
3. Understand how soil organic matter is increased or decreased by agronomic practices.
4. Understand the importance of soil micro-organisms to soil health and how these microbes can be affected by weather soil chemistry, soil physical properties, and agronomic practices.

D. Soil water
1. Understand factors that influence water infiltration and runoff.
2. Understand factors that influence water and solute movement across land surfaces and through soil profiles (vertically and laterally).
3. Recognize practices used to control excess soil water including surface and subsurface drainage.
4. Irrigation
    a. Know the water requirements at different crop stages of development and be able to estimate yield loss from moisture stress.

    b. Recognize advantages and disadvantages of irrigation methods.
    c. Understand the principles behind fertigation.
5. Know how to use water conserving practices in crop management.

E. Plant-water relations
1. Define evaportranspiration (ET) and potential evaportranspiration (PET).
2. Understand how ET and PET are used to make decisions about irrigation.
3. Describe how wind, temperature, solar radiation, relative humidity, and leaf area affect ET.

F. Erosion and soil conservation
1. Understand the steps involved in wind and water caused soil erosion.
2. Understand how soil properties; landscape characteristics; rainfall duration and

intensity; wind velocity; and crop cover affect soil erosion.
3. Recognize the factors of the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) that are used to estimate soil loss.
4. Understand the following erosion control practices: residue management, contouring, strip cropping, terraces, grass waterways, crop rotation, vegetative filter strips, wind breaks, cover crops.
5. Know advantages, disadvantages, and relative effectiveness of common erosion control practices.
6. Recognize the components of an approved conservation plan and its relationship to crop management decisions.
7. Know how to estimate soil residue cover.

G. Tillage
1. Define the following tillage systems and know their effect on residue: no-tillage, clean tillage, strip tillage, mulch tillage, ridge tillage, stale seedbed.
2. Recognize how environment, soil properties, crop productivity, crop rotation, and regulations influence tillage selection.

H. Water and air quality
1. Define point and non-point sources of pollution.
2. Understand the effects of agricultural pollutants (nutrients, pesticides, sediment) on water quality for different types of water resources, and their importance relative to other pollutants (metals, organics, pathogens).
3. Know best management practices (BMPs) to minimize movement of agricultural pollutants to water and air resources.
4. Know legal limits for agricultural pollutants in different types of water bodies.

I. Federal regulations and policy
1. Recognize the intended environmental benefits of: conservation compliance, sodbuster, swampbuster, conservation reserve program, wetlands reserve program.

J. Precision agriculture
1. Understand how site-specific management, geographic information system (GIS), global positioning system (GPS), grid soil sampling, yield mapping, variable rate technology (VRT), and remote sensing can be used in soil and water management.

III. Pest Management

A. Principles of integrated pest management
1. Understand the basic concepts of integrated pest management: prevention, avoidance, monitoring, and suppression.
2. Describe the components of an integrated pest management program including: sampling and monitoring, identification, decision making, method evaluation, implementation, evaluation and record-keeping.
3. Know the definitions of economic threshold and economic injury level and how they are used in decision making for pest control.
4. Describe standard scouting procedures for major pests.
5. Understand how pesticide resistance develops and describe management practices to prevent or delay development of pesticide resistance in insects, weeds, or pathogens.
6. Understand how site-specific management, geographic information system (GIS), global positioning system (GPS), grid soil sampling, yield mapping, variable rate technology (VRT), and remote sensing can be used in pest management.

B. Weeds

1. Be familiar with the methods of identification, life cycle, anatomy, biology and control of common Missouri weeds listed in Appendix A.
2. Recognize plant parts that are used to identify weeds at all growth states.
3. Recognize the importance of each of the following factors affecting weed problems and weed-crop interference: light, water and nutrient competition; crop and weed growth rates; crop and weed germination patterns; duration and timing of competition; weed seed dormancy; vegetative reproduction, allelopathy, shade tolerance; weed life cycle; contamination of grain and forages.
4. Recognize factors that affect use of cultural (including smother crops and crop rotation), biological, chemical and mechanical weed control (including rotary hoeing and cultivation).
5. Herbicide and herbicide management
    a. Describe advantages and disadvantages to pre-plant incorporated, pre-emergence, post-emergence, and burndown herbicide application and their adaptation to different tillage systems.
    b. Recognize the soil, climatic, and agronomic factors that affect herbicide performance and herbicide recommendations.
    c. Understand how herbicide persistence affects pre-emergence herbicide performance and herbicide carryover.
    d. Understand the relationship among mode of action, chemical family symptomology, and weed control.
    e. Recognize general plant symptoms (weed and crop) caused by the following mode of action groups: photosynthetic inhibitors, cell membrane disrupters, pigment inhibitors, growth regulators, seedling growth inhibitors, lipid synthesis inhibitors, and amino acid inhibitors.
    f. Understand relationship of plant vigor and growth stage to herbicide effectiveness and crop susceptibility to damage.
    g. Describe types, purposes, and advantages of herbicide adjuvants.
    h. Understand weed management with herbicide tolerant crops.

C. Diseases
1. Distinguish between abiotic and biotic plant diseases.
2. Understand the differences among viruses, bacteria, fungi, and nematodes with respect to: physical characteristics, inoculum sources, means of dissemination, means of survival, and characteristic symptoms.
3. Be familiar with the methods of identification, type of pathogen, source of inoculum and management of common Missouri field crop diseases listed in Appendix B.
4. Understand how environment, the host plant, and the pathogen interact in the development of crop diseases.
5. Know the difference between signs and symptoms of plant diseases and describe how signs and symptoms are used to identify crop diseases.
6. Understand how crop management practices and environmental conditions affect crop disease incidence and severity.
7. Describe the advantages and disadvantages of genetic, cultural, biological, and chemical control of plant diseases.
    a. Know the definitions of resistant, immune, susceptible, tolerant, and race.
    b. Know the definitions of systemic fungicides; contact or protectant fungicides; and eradicant fungicides.
    c. Understand the difference between broad spectrum and narrow spectrum (or selective)fungicides.
    d. Understand the differences among fungicides, nematicides, and bactericides.
    e. Describe factors that may influence fungicide use and efficacy.
8. Know the definition of mycotoxin; understand factors that influence the production of mycotoxins; know the fungi, which produce vomitoxin, aflatoxin, zearalenone, fumonisin, and ergot alkaloids as well as the corps in which these mycotoxins may be produced; understand the means of minimizing mycotoxin

problems in grain.

D. Insects and mites
   1. Be familiar with methods of identification, crop injury symptoms, and management of insects and mites common in Missouri (Appendix C).
   2. Describe how mouthpart type and feeding habit affect plant injury.
   3. Recognize how the following characteristics of insects influence their ability to survive and cause damage:
      a. development time and period of activity
      b. reproduction method, rate, and number of generations
      c. overwintering and oversummering strategies
      d. dispersal and movement strategies
      e. behavioral characteristics
      f. types of metamorphosis
   4. Recognize how insect life stage, timing of pest occurrence and plant development status affect management decisions.
   5. Describe the advantages and disadvantages of genetic, cultural, biological, and chemical control of insects and mites.
   6. Be able to identify common insect predators and parasitoids and their potential impact on pest insects (Appendix D).
   7. Understand how crop rotation, cropping sequence, planting date, other agronomic practices, and weather influence insect and mite populations.
   8. Understand the use of transgenic crops and associated insect resistance management techniques.
   9. Understand how weather affects insect development and damage potential including the degree day concept of insect development.
   10. Insecticides and and insecticides management
      a. Recognize the effects of insecticides on non-target organisms such as bees, birds, and fish.
      b. Understand factors that influence the development of pesticide resistance in target organisms.
      c. Describe management practices that reduce the probability of developing insect resistance to insecticides.
      d. Relate timing of insecticide application to pest stage of development
      e. Distinguish among contact insecticides, stomach poisons, and systemic insecticides.

E. Pesticides and their application
   1. Recognize physical characteristics of the following pesticide formulations: water soluble powders, water soluble liquids, wettable powders, emulsifiable concentrates, water dispersible granules, dusts, pellets, granules.
   2. Know how to calibrate granular applicators.
   3. Know how to calibrate pesticide sprayers and describe pattern relative droplet size, pattern overlap, and primary uses for the following nozzle types: standard flat fan, even flat fan, hollow cone, and flood tip.
   4. Recognize how spray pressure, application speed, nozzle type, nozzle spacing and weather conditions, affect spray delivery, spray coverage, and spray drift.
   5. Pesticide behavior in the environment
      a. Understand how movement of pesticides in soil, surface water, and ground water may be affected by: soil texture, soil pH, CEC, leaching, erosion, depth to water table, precipitation and runoff, pesticide adsorption and solubility, pesticide degradation rate, pesticide application rate and timing.
      b. Define pesticide persistence and describe the influence of soil moisture, soil temperature, soil pH, permeability of soil, application rate, and weather on pesticide persistence and fate.
      c. Describe the degradation and transfer process that affects the performance of all pesticides, especially herbicides.

F. Laws and regulations related to agri-chemicals
   1. Know the information that must be printed on pesticide labels and how to use that information for safe, effective and environmentally sound pesticide recommendations.
   2. Define: dermal toxicity, oral toxicity, LD_{50}.
   3. Relate pesticide reentry times and harvest restrictions to human exposure.
   4. Describe proper procedures for disposal of pesticides and their containers.
   5. Describe safe storage procedures for pesticides.
   6. Know proper reporting and cleanup procedures for pesticide spills.
   7. Know modes of pesticide entry into human bodies.
   8. Know state and federal rules for record keeping.
   9. Describe protective gear used during mixing and application of pesticides including those stated in Workers Protection Safety Standards.
   10. Recognize the responsibilities of and assistance available through the following State and Federal agencies:
       University of Missouri
       University Extension
       Missouri Department of Agriculture
       Missouri Department of Natural Resources
       U.S. Environmental Protection Agency
       U.S. Fish and Wildlife Service
       Natural Resources Conservation Service
       Farm Service Agency

IV. Crop Management

A. Crop adaptation
   1. Understand how climate (temperature and precipitation), soil properties, and land capability class influences cropping system options.
   2. Understand how day length and climate affect hybrid and variety selection.
   3. Know the minimum, optimum, and maximum temperatures for seed germination and growth for corn, soybean, cotton, wheat, grain sorghum, cool season grasses, warm season grasses, and forage legumes.

B. Crop growth and development
   1. Know the important growth stages for soybean, corn, cotton, wheat, grain sorghum, rice, and forages.
   2. Understand how water and nutrient requirements change during growth and development and which stages are most sensitive to stress.
   3. Distinguish between determinate and indeterminate growth habits.
   4. Relate the growing degree day (GDD) concept to crop development and be able to calculate GDD for corn, cotton, rice, and wheat.
   5. Understand the affects of temperature extremes on plant growth, crop development, and crop quality.

C. Crop damage, mortality, and replant decisions
   1. Understand the consequences of damage from hail, frost, drought, wind, flooding and pest defoliation to plant growth and crop yield and the relationship between the magnitude of crop damage and stage of development.
   2. Recognize weather factors and plant characteristics that influence the ability of plants to resume growth or recover from damage.
   3. Know how to assess crop damage and determine if replanting is warranted.
   4. List the general steps involved in diagnosing a crop abnormality.

D. Variety (hybrid) development and selection
   1. Know the differences between hybrids and varieties (cultivars) and how these differences influence management decision.

2. Know characteristics used for selecting hybrids and varieties.
3. Distinguish between transgenic and non-transgenic plants.
4. Know how to use least significant difference (LSD) to compare hybrids and/or varieties.
5. Define identity preserved varieties.

E. Tillage
   1. Know the effect of residue cover on crop growth through changes in soil temperature, soil moisture, gas exchange, and compaction.
   2. Know tillage implements commonly used for the following tillage systems: no-tillage, clean tillage, strip tillage, mulch tillage, ridge tillage.
   3. Describe the effect of tillage system choice on other crop management practices.

F. Seeds and seeding
   1. Understand characteristics used to measure seed quality.
   2. Know how to calculate purity, germination percentage, pure live seed percentage, and true seed cost.
   3. Know how to measure and calculate seeding rates and how to adjust for pure live seed percentage.
   4. Describe crop responses to planting patterns and densities.
   5. Understand how planting date affects crop establishment, growth, yield, and quality.
   6. Know how seed size, emergence type, soil conditions, planting date, and weather may influence seeding depth.

G. Forage Management, harvest, and storage
   1. Match forage species in the following categories to climate, soil properties, and expected use.
      a. Cool season grasses
      b. Warm season grasses
      c. Legumes
      d. Grains used for silage
   2. Grazing systems
      a. Define the following terms: stocking rate, stock density, carrying capacity, animal unit, grazing pressure, paddock, continuous grazing, rotational grazing, management intensive grazing.
      b. Understand the principles involved in dividing pastures into multiple paddocks.
   3. Hay
      a. Know appropriate stages of development for harvesting legumes and grasses as hay.
      b. Know proper moisture content for hay preservation.
      c. Know limitations of chemical desiccants and hay preservatives.
      d. Understand the effect of frequency and timing of harvest on stand persistence and forage quality.
   4. Silage and haylage
      a. Know appropriate stages of development for harvesting legumes, grasses, and grains as silage.
      b. Understand conditions necessary for proper fermentation and silage preservation.
      c. Understand advantages and disadvantages of silage additives including acids, inoculum, ground grain, sugars, and water.
      d. Understand the importance of fine chopping and wilting of forage grasses and legumes to silage preservation.
   5. Anti-quality components in forages
      a. Know the major toxic factors that may be found in forages: Nitrates, prussic acid, fescue toxicosis, coumarin in sweetclover, mineral

deficiency (tetany).
   b. Understand forage management procedures to decrease occurrence or counteract toxic factors.

H. Grain and fiber crop harvest, drying, and quality
   1. Define physiological maturity and harvest maturity.
   2. Understand the use of defoliants and desiccants.
   3. Know recommended harvest moisture percentages for corn, soybean, wheat, and grain sorghum.
   4. Understand the effect of grain temperature and moisture on safe storage time.
   5. Understand the advantages and disadvantages of aeration, artificial (heat) drying, and high moisture storage of grains.
   6. Understand the importance of seedcoat integrity to grain storage and effects of grain characteristics, harvest and handling on seedcoat breakage.
   7. Understand characteristics used to assess grain quality and what factors account for dockage at point of sale.

I. Cropping systems
   1. Compare and contrast continuous and crop rotation systems.
   2. Define double-cropping, relay cropping, and inter-cropping, green manure crops, cover crops, and companion crops.
   3. Know limitations to double-cropping and know wheat and soybean management recommendations in a double-cropped system.
   4. Understand site-specific management, geographic information system (GIS), global positioning system (GPS), grid soil sampling, yield mapping, variable rate technology (VRT), and remote sensing can be used in crop management.

Appendix A: Common Weeds in Missouri

Barnyardgrass
Broadleaf signal grass
Common cocklebur
Common ragweed
Crabgrass species
Giant foxtail
Giant ragweed
Goosegrass
Hemp dogbane
Hophornbeam copperleaf
Jimsonweed
Johnsongrass
Common lambsquarters
Entireleaf morningglory
Ivyleaf morningglory
Pitted morningglory
Yellow nutsdege
Fall panicum
Prickly sida
Shattercane
Smartweed species
Common sunflower
Trumpetcreeper
Velvetleaf
Waterhemp species
Smooth and/or redroot pigweed
Palmer Amaranth

Wild garlic

Appendix B: Common and Emerging Field Crop Diseases in Missouri

Corn

- Seed decay and seedling blights
- Foliage diseases
  - Gray leaf spot
  - Common rust
  - Southern rust
  - Anthracnose
- Stalk rots
  - Fusarium stalk rot
  - Gibberella stalk rot
  - Anthracnose stalk rot
  - Diplodia stalk rot
  - Charcoal rot
- Ear and kernel rots
  - Aspergillus flavus
  - Diplodia ear rot
  - Gibberella ear rot
  - Penicillium rot
  - Fusarium ear rot
- Crazy top
- Common smut
- Maize dwarf mosaic virus
- Stewart's wilt
- Corn nematodes

Grain sorghum

- Seed and seedling diseases
- Foliage diseases
  - Anthracnose
  - Zonate leaf spot
- Root and stalk rots
- Charcoal rot
- Maize dwarf mosaic virus
- Crazy top
- Sorghum downy mildew
- Head smut, blights and molds

Alfalfa

- Aphanomyces seedling blight
- Pythium seedling blight
- Phytophthora seedling blight and root rot
- Foliage diseases
  - Spring black stem
  - Summer black stem
  - Common leaf spot
  - Lepto leaf spot

- Downy mildew
- Rust
- Anthracnose
- Root and crown rots
- Wilt diseases
  - Fusarium wilt
  - Bacterial wilt
  - Verticillium wilt
- Alfalfa mosaic virus

Soybean

- Pythium damping-off
- Rhizoctonia root rot
- Fusarium root rot
- Phytophthora root rot
- Foliage diseases
  - Frogeye leaf spot
  - Septoria brown spot
  - Bacterial blight
  - Downy mildew
  - Cercospora blight
- Soybean cyst nematode
- Root-knot nematode
- Charcoal rot
- Sudden death syndrome
- Virus diseases
  - Bean pod mottle virus
  - Soybean mosaic virus
  - Tobacco ringspot virus
- Pod and stem blight
- Anthracnose
- Stem canker
- Southern blight
- Purple seed stain

Appendix B: (continued)

Winter Wheat

- Seedling diseases
- Foliage diseases
  - Septoria leaf blotch
  - Tan spot
  - Leaf rust
  - Stem rust
  - Powdery mildew
  - Bacterial stripe and black chaff
- Cephalosporium stripe
- Take-all
- Virus diseases

- Barley yellow dwarf virus
- Wheat spindle streak mosaic virus
- Soilborne wheat mosaic
- Wheat streak mosaic

- Scab or Fusarium head blight
- Loose smut

Cotton

- Cotton seedling disease complex
- Root-knot nematode
- Verticillium wilt
- Fusarium wilt
- Bacterial blight

Rice

- Rice blast
- Sheath blight
- Brown spot

Emerging or Potential Diseases

- Sorghum ergot
- Sclerotinia white mold of soybean
- Brown stem rot of soybean
- Karnal bunt of wheat

Appendix C: Common and Emerging Insect and Mite Pests in Missouri

Alfalfa

- Alfalfa weevil
- Fall armyworm
- Variegated armyworm
- Blister beetles
- Potato leafhopper

Corn and Grain Sorghum

- Corn leaf aphid
- Greenbug (aphid)
- Fall armyworm
- True armyworm
- Billbugs
- Chinch bug
- Corn earworm
- European corn borer
- Southwestern corn borer
- Northern corn rootworm
- Western corn rootworm
- Southern corn rootworm
- Black cutworm
- Dingy cutworm
- Flea beetles
- Grape colaspis
- Grasshopper species
- Seed corn beetle
- Seed corn maggot
- Sorghum midge
- Sorghum webworm
- White grub species
- Wireworm species

Soybean
- Bean leaf beetle
- Two-spotted spider mite
- Green cloverworm
- Corn earworm
- Seed corn maggot
- Grasshopper species

Wheat
- Bird cherry-oat aphid
- Greenbug (aphid)
- True armyworm
- Cereal leafbeetle
- Hessian fly
- Grasshopper species

Cotton
- Aphids
- Boll weevil
- Boll worm
- Thrips
- Plant bugs

Rice
- Rice water weevil

Emerging Insect Problems
- Grape colaspis on corn and soybean
- Corn leaf beetle

Appendix D: Beneficial Insects and Insect Pathogens

Predators
- Lady beetles of “ladybugs”
- Lacewings
- Hover flies
- Predaceous stinkbug
- Damsel bug
- Ground beetles

Parasitoids
- Parasitic wasps
- Tachinid flies

Pathogens
- Nomuraea rileyi