Exam Knowledge Expectations for
Qualified Applicator Certificate & Qualified Applicator License
Category D – Plant Agriculture

Use these knowledge expectations (KEs) to help study the suggested material, The Safe and Effective Use of Pesticides, Third Edition. University of California Integrated Pest Management Program (UC IPM), 2016. The Plant Agriculture Pest Control: A Study Guide for Applicators. University of California Integrated Pest Management Program (UC IPM), 2019. Knowing the information from all of the KEs should prepare you for taking the exam.

I. Integrated Pest Management (IPM)

A. Describe the ways non-chemical pest control methods work with an organism's biology.
B. Explain how planting transgenic crops can affect a pest management plan targeting insects or mites.
C. Describe host plant resistance in relation to disease management.
D. Explain how planting transgenic crops can affect a weed management plan.
E. Describe host-plant resistance in relation to nematode management.
F. Explain how pest-related transgenic crops fit into an IPM program.
G. Explain the relationships among the components of an effective IPM program.
H. Describe non-chemical pest management practices.
I. Explain why monitoring both before and after pesticide application is critical to effective pest management.

II. Pest Identification, Biology, and Management

A. Explain why it is important to know how living organisms are classified and named, and name the two components that make up an organism's scientific name.
B. Explain why understanding the life history, including accurate identification of life stages, of both pests and crops is critical to effective pest management.
C. Describe the ways pesticides work with an organism's biology, including the biological factors that may alter a pesticide's effectiveness.
D. List important California pests and describe:
    a. crop(s) they damage
    b. management techniques
E. Describe the anatomical difference between insects and mites.
F. Describe the life cycle/life stages of the following:
    a. insects with complete metamorphosis
    b. insects with incomplete (simple) metamorphosis
    c. mites
    d. annual, biennial, and perennial weeds
    e. nematodes
    f. vertebrate pests
    g. pathogens

G. Describe common sources of the following:
   a. insects and mites
   b. inoculum
   c. weeds
   d. nematodes
H. Describe different types of characteristic damage (symptoms and signs) caused by the following:
   a. insects and mites
   b. plant disease
   c. weeds
   d. abiotic factors
   e. nematodes
   f. vertebrate pests
I. Define the three parts of the disease triangle and explain why they must all be present for disease to occur.
J. Describe the differences between broadleaf weeds, grasses, and sedges.
K. Describe how nematodes can spread.
L. List the major groups of vertebrates and describe how they can become pests.
M. Explain how to identify vertebrate pests using direct and indirect methods.

III. Pesticide Use

A. Discuss types of insecticides/miticides and describe which type works best in a given situation.
B. Discuss types of pesticides used for disease control and describe which type works best in a given situation.
C. Discuss types of herbicides for weed control and describe which type works best in a given situation.
D. Discuss types of nematicides and describe which type works best in a given situation.
E. Describe the factors to consider when making pesticide use decisions.
F. Discuss types of pesticides used to manage vertebrate pests and describe which type works best in a given situation.
G. Describe methods for making poison baits more selective.
H. List the indications that a tank mix of two or more formulations is incompatible.
I. Describe the importance of selecting pesticides with varying modes of action, including the management, prevention, or delay of resistance development in target organisms.
J. Explain the various fates of pesticides in the environment and how understanding these fates affect pesticide selection and application decisions.

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IV. Safe Use

A. Explain how to determine if weather conditions at the application site will cause off-site movement.
B. List common errors that can occur when applying pesticides and describe the problems that can result from these errors, including legal and economic consequences.
C. Describe various pesticide application equipment used to apply pesticides in plant agriculture settings.
D. List components of liquid application equipment, explain how they work together, and identify which components work best with which pesticide formulations.
E. Describe the parts of a nozzle.
F. Describe types of nozzles, including outputs, patterns, and applications that require each output or pattern.
G. Describe types of pumps and how to select the best pump for particular situations.
H. Describe different types of characteristic damage (symptoms and signs) caused by the following:
    a. liquid sprayers
    b. dust applicators
    c. granular applicators
    d. chemigation equipment
I. Describe procedures for storing the following:
    a. liquid sprayers
    b. dust applicators
    c. granular applicators
    d. chemigation equipment
J. Define common problems with pesticide application equipment and describe how these might be remedied.
K. List components of chemigation equipment, explain how they work together, and identify which components work best with which pesticide formulations.
L. List the adjustments to application equipment to improve inadequate spray coverage or pesticide placement.
M. Explain how to select the right equipment for effective applications to common plant structures.
N. Describe various pesticide application methods.

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V. Effective Use

A. Describe the ways to prevent incompatibility when tank mixing pesticides.
B. Describe the factors that can affect the outcomes of pesticide applications.
C. List the advantages and disadvantages of using multiple pesticides in one tank (tank mix).
D. Explain how the proper use of pesticides contributes to the management of pesticide resistance.
E. Explain how pesticide resistance develops and describe ways to manage it.
F. Explain how to monitor and account for pesticide underperformance and list the ways to avoid it.
G. Describe thresholds used to make treatment decisions, and explain how to use these thresholds to determine if pesticide application is needed.
H. List and describe the tools available for monitoring agricultural pest populations before, during, and after a pesticide application.
I. Describe methods used to properly time pesticide applications and increase their effectiveness.
J. Explain how weather conditions at the application site can impact the effectiveness of pesticide applications.
K. Explain how to prevent pesticides from moving into non-target areas.
L. Describe the different types of resistance to pesticides, how each occurs, and how to manage each.
M. Describe several methods that help determine whether adequate pesticide coverage is being achieved.

VI. Pesticide Applications

A. Knowledge of pesticide types, formulations, and appropriate uses for the following: insecticides, herbicides, rodenticides, avicides, plant growth regulators, adjuvants, fungicides, nematicides, and microbial pest control agents.
B. Knowledge of pesticide application equipment including; cleaning and maintenance, safe and effective use, sprayer types, calibration, pressure, droplet size, and nozzle choice.
C. Ability to complete pesticide related calculations and conversions including: flow rate, dosage, spray volume, application rate, and area.
D. Ability to read and understand pesticide labeling.

VII. Protection of Human Health and Environmental Exposure

A. Knowledge of applicator safety including; safe and effective use of personal protective equipment (PPE), respirators, decontamination, pesticide disposal, pesticide residues, and restricted entry intervals (REIs).
B. Knowledge of safe pesticide use practices to prevent drift, groundwater contamination, and environmental contamination.