Module 8 — Pest Identification, IPM & Resistance Management

CORE exam · 9 practice questions · Why identification comes first, how thresholds and scouting work, the IPM tactic hierarchy, modes of action, and how resistance actually develops.

Key numbers & facts to memorise

Step one	Correct pest identification
Economic threshold	LOWER than the economic injury level
Tactics	Cultural · Mechanical/physical · Biological · Chemical
Resistance	Rotate MODES OF ACTION (HRAC/WSSA, IRAC, FRAC) — not brand names
Rate cutting	Sub-lethal rates ACCELERATE resistance

Identification first — everything else depends on it

Correct **pest identification** is the first step of every pest management decision, and the most common cause of a failed application is not a bad product but a misidentified target. A grass herbicide will not control a sedge. A fungicide will not fix a nutrient deficiency that looks like disease. An insecticide timed to a larval stage does nothing to eggs. Before you choose chemistry, name the organism and know its life stage.

Practical identification means using resources rather than guessing: extension diagnostic guides, the OSU Extension plant and pest diagnostic clinic, regional pest alerts, and photographs of damage patterns. Distinguish the **pest** from the **damage symptom** — chewed leaves narrow the field but do not name the insect — and remember that most organisms in a field are neutral or beneficial. Predators, parasitoids and pollinators are the reason broad-spectrum insecticides sometimes make a pest problem worse in the following weeks.

Also identify the **site**, not just the pest. The crop, growth stage, soil type, neighbouring sensitive crops and the interval to harvest all constrain your options before the product label is even open. This is exactly the reasoning path exam questions follow: identify the pest, identify the site, check the label, then decide.

Economic thresholds, scouting and the decision to spray

Integrated Pest Management (IPM) is a decision system, not an ideology: use monitoring and multiple tactics to hold pests below economically damaging levels while minimising cost, resistance and non-target harm. Two definitions carry most of the exam weight. The **economic injury level (EIL)** is the pest density at which the cost of damage equals the cost of control. The **economic threshold (ET)**, or action threshold, is the density at which you must act to prevent reaching the EIL — necessarily **lower** than the EIL, because control takes time to work.

Scouting is what makes thresholds usable. Walk a defined pattern, sample enough locations to represent the field, count rather than impress yourself, and record what you find with the date and growth stage. Sweep nets, sticky cards, pheromone traps, soil sampling and simple plant counts all have their place. Over a season, records turn into a map of where problems recur, which is worth more than any single scouting trip.

The decision to spray then becomes arithmetic rather than reflex: expected yield loss × crop value versus product plus application cost, adjusted for the probability that conditions favour the pest. Sometimes the answer is a targeted spot treatment of ten acres rather than a blanket pass over 300. Drone application is unusually well suited to that answer, and it is a legitimate selling point — precision where a threshold has actually been crossed.

The IPM tactic hierarchy

Cultural controls change the environment so the pest does less well: crop rotation, resistant varieties, planting date adjustment, sanitation, tillage decisions, row spacing, irrigation timing and fertility management. These are cheap, durable and cumulative, and they are the answer to a surprising number of exam questions that appear to be about chemicals.

Mechanical and physical controls remove or exclude the pest directly — cultivation, mowing, hand-removal, barriers, traps, screens, mulches. **Biological** controls use natural enemies: conserving resident predators and parasitoids, releasing commercially reared beneficials, or applying microbial products such as *Bacillus thuringiensis*. Conservation of what is already present is usually more cost-effective than releases.

Chemical control is one tool inside the system, used when monitoring shows a threshold has been crossed and non-chemical tactics are insufficient. Deployed that way, chemistry stays effective for years. Deployed as the only tactic on a calendar schedule, it selects hard for resistance and often for secondary pest outbreaks when natural enemies are removed.

Modes of action and resistance management

Resistance is the inherited ability of a pest population to survive an application that previously controlled it. The mechanism is straightforward natural selection: a few individuals carry genes that let them survive, they reproduce, and repeated use of the same chemistry raises their share of the population until the product appears to stop working. The product did not weaken; the population changed.

The single most important management principle is to **rotate modes of action, not just product names**. Two differently branded products can share one mode of action, and rotating between them provides no resistance benefit whatsoever. Use the classification codes: **HRAC/WSSA groups** for herbicides, **IRAC** for insecticides, **FRAC** for fungicides. These group numbers are printed on modern labels precisely so you can rotate meaningfully.

Layer the other tactics. Apply **full labelled rates** — cutting rates leaves survivors and accelerates selection. Use **tank mixes or premixes with two effective modes of action** against the same pest where appropriate. Include non-chemical tactics so chemistry is not carrying the whole load. Control escapes and weed seed before they set seed. Preserve refuges of untreated susceptible individuals where the crop system allows. And scout after application: an unexplained control failure is worth investigating rather than repeating, because the response to real resistance is a different mode of action, not a higher rate of the

same one.

Practice questions

Answer these closed-book, then check against the answer key that follows. Ohio requires 70% to pass.

1. The first step in any pest management decision is:

A) Choosing a pesticide
B) Correctly identifying the pest
C) Calibrating the sprayer
D) Filing a record

2. The economic threshold is:

A) Higher than the economic injury level
B) Lower than the economic injury level
C) The same as the economic injury level
D) Unrelated to pest density

3. The economic injury level is the pest density at which:

A) Any pest is present
B) The cost of damage equals the cost of control
C) The crop dies
D) Scouting begins

4. Which is a cultural control?

A) Applying an insecticide
B) Crop rotation and resistant varieties
C) Releasing lady beetles
D) Hand-pulling weeds

5. Releasing or conserving natural enemies of a pest is:

A) Cultural control
B) Biological control
C) Mechanical control
D) Chemical control

6. The most effective way to delay pesticide resistance is to:

A) Use the same product every application
B) Rotate modes of action, not just product brands
C) Reduce the rate below the label
D) Spray on a fixed calendar

7. Applying less than the labelled rate to save money:

A) Reduces resistance risk
B) Increases resistance risk by leaving survivors
C) Has no effect on resistance
D) Is required by IPM

8. HRAC/WSSA, IRAC and FRAC codes on a label indicate:

A) Signal word category
B) Mode-of-action group for resistance management
C) Re-entry interval
D) Storage temperature

9. In IPM, chemical control is best described as:

A) The first tactic to try
B) One tool used when monitoring shows a threshold has been crossed
C) Never acceptable
D) Required annually

Answer key & explanations

1. B) Correctly identifying the pest — Identification drives every subsequent choice — product, timing, rate and whether treatment is needed at all.

2. B) Lower than the economic injury level — The threshold is set below the EIL so control can be applied before economic damage occurs.

3. B) The cost of damage equals the cost of control — At the EIL, damage cost equals control cost — above it, treatment pays for itself.

4. B) Crop rotation and resistant varieties — Cultural controls modify the growing environment: rotation, variety selection, planting date, sanitation and fertility.

5. B) Biological control — Biological control uses predators, parasitoids and pathogens, including microbial products like Bt.

6. B) Rotate modes of action, not just product brands — Different brands can share a mode of action. Rotate using HRAC/WSSA, IRAC or FRAC group numbers.

7. B) Increases resistance risk by leaving survivors — Sub-lethal doses let partially resistant individuals survive and reproduce, accelerating selection.

8. B) Mode-of-action group for resistance management — These group codes let you rotate genuinely different modes of action rather than different brand names.

9. B) One tool used when monitoring shows a threshold has been crossed — IPM integrates cultural, mechanical, biological and chemical tactics, with chemistry applied on the basis of monitoring.