

**KNOWLEDGE EXPECTATIONS FOR PEST CONTROL ADVISERS:
WEED CONTROL**

I. WEED ID

1. Recognize the major plant characteristics used to identify weeds. Define and locate:
 - a. cotyledons;
 - b. first true leaf;
 - c. collar;
 - d. leaf blade;
 - e. node;
 - f. internode;
 - g. leaf sheath;
 - h. petiole;
 - i. auricle;
 - j. ligule;
 - k. awn;
 - l. hypocotyl;
 - m. inflorescence;
 - n. coleoptile;
 - o. tuber;
 - p. rhizome;
 - q. stolon;
 - r. bulbs.
2. Recognize the key features used to identify:
 - a. grass seedlings;
 - b. broadleaf seedlings.
3. Identify 50 common weed species or genera in mature stages of development by common name, see list on pages 8 & 9.
4. Identify 25 common weed species or genera in seedling stage by common name, see list on pages 9 & 10.
5. Classify the 50 common weed species in #3 above as generally a(n):
 - a. annual (summer or winter);
 - b. perennial;
 - c. biennial;
 - d. dicot;
 - e. monocot.
6. Recognize that the following weeds are poisonous to animals:
 - a. jimsonweed;
 - b. nightshades;
 - c. common groundsel;
 - d. coast fiddleneck;
 - e. yellow starthistle.
7. Identify types of vegetative propagules.

8. Recognize unique seed or vegetative growth structures that plants have which aid in dispersal and provide examples of weeds which have them:
 - a. plants with burs or spiked seeds that catch in animal fur (filaree, puncturevine, wild oat, foxtail barley, hare barley)
 - b. plants that disperse their seed with tumbling plant parts (Russian thistle);
 - c. plants with seed that are pappus-bearing for dispersal by wind (hairy fleabane, common groundsel, cattails);
 - d. plants which spread with vegetative propagules (Johnsongrass, yellow nutsedge, field bindweed);
 - e. plants that produce prolific small seed (purslane, pigweed, smallflower umbrella sedge).
9. List information that should be recorded when monitoring for weeds.
10. List resources to assist in weed identification.

II. WEED BIOLOGY

A. Functions of Plant Parts

1. Describe the function of the following plant parts:
 - a. xylem (apoplast);
 - b. phloem (symplast);
 - c. chloroplast;
 - d. membranes;
 - e. endodermis;
 - f. epidermis;
 - g. cuticle;
 - h. apical meristem;
 - i. root hairs;
 - j. root tip (meristem);
 - k. stomata.

B. Germination requirements

1. Describe the conditions necessary for weed seeds to germinate.
2. Compare how differing weed germination requirements affect management decisions.
3. Define seed dormancy.
4. Describe some factors that regulate or break seed dormancy:
 - a. scarification/penetration of the hard seed coat;
 - b. chemical inhibition;
 - c. temperature.
5. Describe the effect of seed size on dormancy and the depth from which a weed seed can successfully germinate.

C. Life cycles and growth habits

1. Define:
 - a. annual;
 - b. perennial;
 - c. biennial;
 - d. summer annual;
 - e. winter annual;
 - f. dicot;
 - g. monocot.

D. Growth rates/competition

1. Describe the influence of:
 - a. seasonal changes on the weed spectrum;
 - b. weed growth on water and nutrient availability to the crop;
 - c. temperature on plant growth.
2. Recognize the importance of light and space in plant growth and development.

E. Reproduction

1. Describe the reproductive capability of weeds, including:
 - a. Seeds;
 - b. vegetative reproductive structures/propagules.
2. Describe the mechanisms by which weed seeds are disseminated.
3. Describe how the following factors contribute to regulating the seed bank and seed longevity:
 - a. biotic factors of the environment, such as natural decay;
 - b. loss of seed viability;
 - c. production practices, such as applications of preemergence herbicides;
 - d. cultural practices.
4. Describe how different types of vegetative propagules spread.

II. WEED MANAGEMENT

A. Using sampling and recordkeeping in weed management decisions

1. Describe how to map a field in relationship to weed management considerations.
2. List information necessary to document a field's weed history.
3. Identify methods and patterns for sampling weeds (*IPM in Practice* chapter 6):
 - a. absolute vs. relative sampling;
 - b. random, systematic and stratified sampling patterns.
4. Identify essential times during which monitoring should be done for:
 - a. annual weeds;
 - b. perennial weeds.

B. Biological Control Methods

1. Define biological control.
2. Describe and give an example of biological weed control using:
 - a. arthropods;
 - b. pathogens;
 - c. grazing animals.
3. Identify the factors that would limit the use of biological control for weeds.

C. Crop Culture

1. Describe the impact of the following practices on weeds:
 - a. seedbed preparation;
 - b. irrigation method;
 - c. irrigation timing;
 - d. time of seeding;
 - e. soil nutrition;
 - f. seed/plant spacing;
 - g. crop variety;
 - h. crop rotation;
 - i. pre-irrigation (irrigating before planting a crop so that weed seeds germinate and seedlings are controlled);
 - j. synthetic mulches;
 - k. organic mulches;
 - l. sanitation methods.

D. Mechanical/Physical Controls

1. List and describe common cultivation/tillage methods.
2. Describe how weeds (seed germination/vegetative propagation/spread) are affected by:
 - a. depth of tillage;
 - b. timing of tillage;
 - c. no-tillage.
3. Describe cultivation techniques used in perennial crops.
4. Compare the advantages/disadvantages of different cultivation methods.
5. Identify the proper timing for cultivation and hand weeding.
6. Describe the use of the following methods for weed control:
 - a. burning;
 - b. flaming;
 - c. steaming;
 - d. solarization.
7. Describe how control measures using heat affect weed and crop growth.
8. Describe some preventative measures that can be used to manage weeds (certified seed, quarantines, clean equipment).

E. Chemical Control Methods

1. List the various methods used to classify herbicides.
2. Define mode of action and the results of using an herbicide with a given mode of action.
3. List the mode of action for the following herbicide types and recognize these common herbicides:
 - a. amides (propanil);
 - b. bipyridiliums (paraquat, diquat);
 - c. dinitroanilines (trifluralin, pendimethalin);
 - d. diphenylethers (oxyfluorfen);
 - e. glycine (glyphosate);
 - f. phenoxy carboxylic acids (auxinic herbicides, 2,4-D);
 - g. phosphinic acid (glufosinate);
 - h. sulfonyleureas (chlorsulfuron, rimsulfuron);
 - i. thiocarbamates (EPTC, thiobencarb);
 - j. triazines (atrazine, simazine);
 - k. ureas (linuron, diuron).
4. Define:
 - a. phytotoxicity;
 - b. preemergence herbicide;
 - c. preplant incorporated herbicide;
 - d. postemergence herbicide;
 - e. adjuvant;
 - f. herbicide resistance;
 - g. cross-resistance;
 - h. multiple resistance;
 - i. soil persistence;
 - j. plantback restrictions.
5. Describe factors that can cause herbicide injury symptoms on a crop.
6. Describe foliar versus soil application methods for herbicides.
7. Describe how the following factors affect preemergence and preplant soil incorporated herbicide activity:
 - a. incorporation depth;
 - b. herbicide rate;
 - c. soil type and amount of organic matter;
 - d. irrigation type and amount;
 - e. irrigation/rainfall timing.
8. Describe how the following factors affect postemergence herbicide activity:
 - a. plant size and vigor;
 - b. plant growth stage;
 - c. temperature;
 - d. timing;
 - e. wind;
 - f. rainfall;

- g overhead irrigation.
- 9. Describe mechanisms of herbicide selectivity.
- 10. Describe ways:
 - a herbicides are taken into the plant;
 - b. some herbicides move within the plant.
- 11. List the common formulations of herbicides and their properties.
- 12. List reasons for adding an adjuvant to an herbicide formulation.
- 13. Describe soil conditions that:
 - a. enhance the degradation of herbicides;
 - b. increase the persistence or availability of most soil-applied herbicides.
- 14. Define biotype and ecotype. Describe the impact of weed biotypes on herbicide resistance.
- 15. Describe how knowledge of the herbicide mode of action/group number aids in resistance management.
- 16. Differentiate between herbicide tolerance and herbicide resistance in weeds.
- 17. Describe methods used to prevent and manage herbicide resistance.
- 18. Describe the importance of crop rotation in managing herbicide resistance.
- 19. Describe how the following factors affect herbicide movement in the soil (including offsite movement away from the application area):
 - a. herbicide solubility;
 - b. soil texture;
 - c. organic matter;
 - d. time to next irrigation or rainfall event;
 - e. pH.
- 20. Define pesticide drift and describe some of the harmful consequences.
- 21. Describe methods to manage pesticide drift.
- 22. Define the following chemical application methods and identify situations when they are used:
 - a. chemigation;
 - b. wick/wiper;
 - c. incorporation;
 - d. banded;
 - e. broadcast;
 - f. directed;
 - g. shielded;
 - h. layby.

F. Economic Evaluation of Weed Management Actions

1. List the economic factors to be considered in a weed management program.
2. Describe how the cost of weed management can be compared with the benefit of management.

G. Environmental Considerations

1. Identify the factors that contribute to herbicide leaching to ground water.
2. Describe what a ground water protection area (GWPA) is and how it relates to herbicide use and water quality.
3. List factors that affect the behavior of herbicides in the soil and the environment.
4. Describe the impact of the following factors on drift:
 - a. weather (wind, fog, temperature);
 - b. temperature inversion;
 - c. spray pressure;
 - d. droplet size.
5. Describe what volatile organic compounds (VOCs) are and how they relate to herbicide use and air quality.

H. Integrated Weed Management

1. Define integrated pest management as used in agricultural weed control programs.
2. Describe how the following practices can be used in integrated weed management:
 - a. field selection;
 - b. crop rotation;
 - c. use of cover crops and green manures;
 - d. land and seedbed preparation;
 - e. irrigation and fertilization management;
 - f. mechanical control;
 - g. sanitation;
 - h. weed identification;
 - i. herbicide selection.
3. Describe the benefits of an integrated weed management approach.

Lists of Mature and Seedling Weeds from Page 1

I. WEED ID

3. Identify these 50 common weed species or genera in mature stages of development by common name:

Broadleaves

<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Amaranthaceae	Redroot pigweed	<i>Amaranthus retroflexus</i>
Asteraceae	Yellow starthistle	<i>Centaurea solstitialis</i>
	Hairy fleabane	<i>Conyza bonariensis</i>
	Horseweed	<i>Conyza canadensis</i>
	Prickly lettuce	<i>Lactuca serriola</i>
	Common groundsel	<i>Senecio vulgaris</i>
Boraginaceae	Annual sowthistle	<i>Sonchus oleraceus</i>
	Coast fiddleneck	<i>Amsinckia menziesii</i> var. <i>intermedia</i>
	Black mustard	<i>Brassica nigra</i>
Brassicaceae	Shepherd's-purse	<i>Capsella bursa-pastoris</i>
	London rocket	<i>Sisymbrium irio</i>
Caryophyllaceae	Common chickweed	<i>Stellaria media</i>
Chenopodiaceae	Common lambsquarters	<i>Chenopodium album</i>
	Russian thistle	<i>Salsola tragus</i>
Convolvulaceae	Field bindweed	<i>Convolvulus arvensis</i>
	Morningglories	<i>Ipomoea</i> spp.
Euphorbiaceae	Spotted spurge	<i>Euphorbia maculata</i>
Fabaceae	Black medic	<i>Medicago lupulina</i>
Geraniaceae	Filaree	<i>Erodium</i> spp.
Lamiaceae	Henbit	<i>Lamium amplexicaule</i>
Malvaceae	Velvetleaf	<i>Abutilon theophrasti</i>
	Mallow	<i>Malva</i> spp.
Oxalidaceae	Bermuda buttercup (Buttercup oxalis)	<i>Oxalis pes-caprae</i>
Polygonaceae	Common knotweed	<i>Polygonum arenastrum</i>
	Smartweeds	<i>Polygonum</i> spp.
Portulacaceae	Purslane	<i>Portulaca olearcea</i>
Solanaceae	Jimsonweed	<i>Datura stramonium</i>
	Groundcherries	<i>Physalis</i> spp.
	Nightshades	<i>Solanum</i> spp.
Typhaceae	Cattails	<i>Typha</i> spp.
Urticaceae	Nettles	<i>Urtica</i> spp.
Zygophyllaceae	Puncturevine	<i>Tribulus terrestris</i>

Grasses

<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Poaceae	Wild oat	<i>Avena fatua</i>
	Large crabgrass	<i>Digitaria sanguinalis</i>
	Junglerice	<i>Echinochloa colona</i>
	Barnyardgrass	<i>Echinochloa crus-galli</i>
	Fescues	<i>Festuca</i> spp.
	Foxtail barley	<i>Hordeum jubatum</i>
	Hare barley	<i>Hordeum murinum</i> ssp. <i>leporinum</i>
	Sprangletops	<i>Leptochloa</i> spp.
	Italian ryegrass	<i>Lolium multiflorum</i>
	Witchgrass	<i>Panicum capillare</i>
	Dallisgrass	<i>Paspalum dilatatum</i>
	Canarygrass	<i>Phalaris canariensis</i>
	Annual bluegrass	<i>Poa annua</i>
	Yellow foxtail	<i>Setaria pumila</i>
	Johnsongrass	<i>Sorghum halepense</i>

Sedges

<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Cyperaceae	Smallflower umbrella sedge	<i>Cyperus difformis</i>
	Purple nutsedge	<i>Cyperus rotundus</i>
	Yellow nutsedge	<i>Cyperus esculentus</i>

4. Identify 25 common weed species or genera in seedling stage by common name:

Broadleaves

<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Amaranthaceae	Redroot pigweed	<i>Amaranthus retroflexus</i>
Asteraceae	Yellow starthistle	<i>Centaurea solstitialis</i>
	Hairy fleabane	<i>Conyza bonariensis</i>
	Prickly lettuce	<i>Lactuca serriola</i>
	Common groundsel	<i>Senecio vulgaris</i>
Boraginaceae	Coast fiddleneck	<i>Amsinckia menziesii</i> var. <i>intermedia</i>
Brassicaceae	Black mustard	<i>Brassica nigra</i>
	Shepherd's-purse	<i>Capsella bursa-pastoris</i>
Caryophyllaceae	Common chickweed	<i>Stellaria media</i>
Chenopodiaceae	Common lambsquarters	<i>Chenopodium album</i>
	Russian thistle	<i>Salsola tragus</i>
Convolvulaceae	Field bindweed	<i>Convolvulus arvensis</i>

Family

Euphorbiaceae
 Geraniaceae
 Lamiaceae
 Malvaceae

 Polygonaceae
 Portulacaceae
 Solanaceae
 Urticaceae
 Zygophyllaceae

Common Name

Spotted spurge
 Filaree
 Henbit
 Velvetleaf
 Mallow
 Common knotweed
 Purslane
 Nightshades
 Nettles
 Puncturevine

Scientific Name

Euphorbia maculata
Erodium spp.
Lamium amplexicaule
Abutilon theophrasti
Malva spp.
Polygonum arenastrum
Portulaca olearcea
Solanum spp.
Urtica spp.
Tribulus terrestris

Grasses**Family**

Poaceae

Common Name

Barnyardgrass
 Annual bluegrass
 Large crabgrass

Scientific Name

Echinochloa crus-galli
Poa annua
Digitaria sanguinalis