

Weeds

Keeping Ahead of the Competition

Overview

Weeds are among the most consistent challenges in crop production systems and can be costly in terms of reduced productivity and the labor, equipment, fuel and chemicals that are used to control them. Farmers have developed many different approaches to managing weeds, using everything from chemical herbicides to hand picking weeds to cultivating with tractors. Each approach has its tradeoffs in terms of effectiveness and associated economic, environmental and human health related costs. Increasingly, the public is seeking food that is grown without synthetic pesticides, including herbicides used to control weeds, out of concerns about personal health and the effects of pesticides on the environment and farm workers.

To lessen the negative impacts of weeds and weed management practices, farmers need to know the effectiveness and consequences of different weed control approaches in different situations. This requires understanding the biology of weeds in relation to crops and farming systems. The following reference resources are provided to improve your familiarity with the topic.

Resource References

University of California, Integrated Pest Management Guidelines: Weed Photo Gallery
http://www.ipm.ucdavis.edu/PMG/weeds_common.html

Principles of Sustainable Weed Management for Croplands, ATTRA
<http://attra.ncat.org/attra-pub/weed.html>

DiTomaso, J.M. and E.A. Healy. 2006. Weeds of California and Other Western States, 2 Volumes. University of California, DANR Publication 3488

Physical Labor Reflection (p133). French Fries and the Food System: A Year-Round Curriculum Connecting Youth With Farming And Food, 1991. by Sara Coblyn. Lincoln and Roxbury: A publication of the Food Project

The Death of Ramon Gonzales: The Modern Agricultural Dilemma, by Angus Wright 1990. University of Texas Press

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Introduction

This activity will introduce students to some of the different weed management strategies that are used by farmers interested in sustainable agriculture. Students will see that farmers need to know how to identify different weeds and their life cycle stages to effectively limit weed competition and produce a successful crop. They will experience labor-intensive hand weeding and compare the method with other weed management strategies in terms of effectiveness, ease of use, and cost. Through this activity, students will gain an appreciation for the complicated decision-making that goes into selecting a weed management approach that is affordable for the farmer and safe for farm workers, consumers, and the environment.

To Lead This Activity You Need to Know

Facilitators of this activity need to have the following basic understandings in order to effectively lead students through this activity:

- How to identify weeds and crops in their different life cycle stages
- How to use various hand weeding tools, such as a hand hoe and wheel hoe
- How to operate or have someone else operate and demonstrate a tractor and cultivator or other mechanical weeding implement
- How mulches, fallows, crop rotations, solarization, and flaming work to control weeds (depending on which methods are available for demonstration)
- Farm worker rights and some history of the farm worker movement (e.g., United Farm Workers)
- Impacts of herbicides on human health and the environment

Key Concepts

- Plant life cycle
- Characteristics of weeds
- Plant competition for resources
- Plant reproduction (sexual, asexual)
- Weed management strategies
- Farm worker health
- Organic agriculture

Objectives

- Distinguish a crop from a weed
- Identify different crops and weeds at differing stages in their life cycles
- Understand how weeds impact crop growth
- Understand how weeds reproduce
- Use different weed management techniques to eliminate or control weed populations
- Understand why farmers might choose different weed management options

- Recognize the impacts associated with different management strategies on people and the environment

Materials

- A farm or garden where a variety of weed management strategies are practiced
- Hand hoes, wheel hoes, or other tools used in labor intensive weed management
- Tractor-mounted weed control implement such as a cultivator or some similar mechanical weeding device (optional)
- Weed I.D. sheets with names and pictures of weeds present in the field or garden to be used; different stages in weeds life cycle should be shown.

Activity (50 minutes)

What is a Weed? (5 minutes)

1. After welcoming the students to the farm and describing how your farm works, walk out in the field and show them different crops with weeds. The weeds can be a small or large problem, but some action needs to be taken to prevent crop damage. Explain that on today's visit they are going to learn about some of the important plants that grow on the farm – weeds!
2. Ask them if they know what a weed is and briefly describe the differences between a crop and a weed. A crop is a plant grown for harvest. Crops help the farmer generate income. List and point out some of the crops growing on your farm. Explain that weeds are plants that grow in the field that were not intentionally planted. Weeds reduce crops productivity and the financial success of a farm. Ask the students to list all the different ways weeds might affect crop performance. Explain that weeds reduce crop productivity by competing for nutrients, light, and water and can have other negative impacts on the farm.
3. Explain that for the next hour they are going to learn how to think like a farmer and at the end of their tour they will have to make a decision on what weed management approaches to take. Before they make their decisions, they are going to learn about several weed management strategies.

Weed Identification (10 minutes)

1. Explain that before farmers can do anything about a weed, they need to know what weed it is. There are hundreds of weeds, but usually between ten and twenty weeds are serious pests on a particular farm. Farmers need to learn the names of these weeds, how they grow, how they reproduce, and how they are best controlled. Ask the students to spend 2-3 minutes counting how many different kinds of weeds they can find around them (they don't need to know the names). After the group shares their numbers, point out and name several of the different weeds.
2. Explain that farmers need to understand the life cycle and reproductive processes of particular weeds if they are to effectively manage weed populations and crop damage. Introduce the concept of a plant's life cycle by handing out the weed plant I.D. sheets and describe how the weeds on the farm reproduce and persist in the field. Explain

that it's necessary for farmers to be able to identify the weed at each stage. Take a look at several weeds and identify the developmental stages in their life cycles.

3. Ask the students how weeds come to be a constant problem in the fields. If you pull them out, why do they keep returning? Show the students a weed that is flowering. Ask the students to guess approximately how many weed seeds can be produced by a single mature weed plant. Explain that there is a seed bank in the soil - a huge reserve of weeds waiting for the right conditions to grow. How might that affect a farmers' decision making about weed management?

Hand-Weeding (20 minutes)

1. To make decisions about crop and weed management strategies, students need to learn about different methods of weed control. Explain that one of the most common forms of weed management on farms is hoeing. Ask them if they know which crops might require lots of hand hoeing (e.g., annual vegetables and flowers). Ask them to help with the important work of weeding one (or more) of the crops on the farm.
2. Give each student a hoe and take them into the field where some brief hoeing can be done. Demonstrate to students the proper way to use a hoe. Ask the students to help hoe the weeds out of the crop. Help any students who need further instruction on how to use the hoe. Let the students hoe for about 10 to 15 minutes. Try to finish a complete row or planting so that the students can be acknowledged for contributing a useful task to the farm.
3. While students are hoeing explain that some weeds are present on all farms, but farmers need to efficiently minimize weed impacts to produce sufficient high quality crops. Farmers can use many different methods to control weeds.
4. If you want, you can time how long it takes the students to hoe the area. Explain that farmers often have to hire laborers and pay them an hourly wage to get fields weeded. Calculate how much it would cost to have paid the students as if they were a weeding crew. You can then multiply that amount by the total area of the field, which will give them some idea of the cost of labor. Explain that weeding can be one of the greatest financial costs in some crops.
5. Ask the students how they feel doing the work. Was it easy or difficult? How might it feel to hoe for 4 hours, or 8 hours, or more, per day? Ask them if any of them have heard of the United Farm Workers or Cesar Chavez. Give them a brief description of their efforts to gain legal rights for farm workers and improve working conditions on farms. Ask the students if they know anything about farm worker protection in your area. Explain that because of the United Farm Workers and legislation that grew out of their work, farmers need to more closely consider the health and well-being of farm workers when they are implementing a weed management strategy.

Other Weed Management Options (10 minutes)

1. After hoeing the chosen area, walk the students to other crops and parts of the farm to show them different weed management approaches. Try to show them as many of the following methods you can - based on the strategies used on your farm and available time.

- Mechanical control. If possible, show them the actual equipment in action and its effects on the crop and weeds. Explain how cultivation works and the advantage of hot, dry conditions which lead to desiccation of the cut weeds.
 - Solarization of an area will kill nearly all weed seeds near the soil surface. It may be possible to show solarization in progress or an area that was previously solarized and has a crop growing in it.
 - Flaming weeds kill weeds by bursting plant cells. This method is exciting for students to see, but should only be demonstrated with great caution for a small group of well-behaved students. Alternatively you can show students an area where flaming has been used recently, and show them the flamer that was used.
 - Mulching with straw, wood chips, black plastic, etc. If you have time (and a willing group of students) you can have students help mulch an area. Explain how mulching prevents weeds from growing by blocking out sunlight. Encourage them to use this method in their gardens or yard at home or similar settings.
2. As you show students each different method, ask them the following questions. When would this strategy be most effective – before the crop is planted, when the weeds are just germinating, when the weeds have their first true leaves, or later? (You can use the weed plant I.D. sheets with life cycle images to help them remember the different plant growth stages.) How does this method impact farm workers, consumers, surface and ground water, and surrounding wildlife? How expensive would this method be to the farmer?
- Decision Making (5 minutes)**
1. Bring the students back to the crops where they were introduced to weeds and weed management problems. Ask the students to break into pairs and spend a few minutes deciding how they would manage the weeds if they were farmers. Remind them that, in reality, good weed control usually requires combining two or more methods. Have each group share their decision with the rest of the participants and explain their reasoning. You might then explain what you would do and why.
 2. Ask the students if any of them considered using herbicides as their way of managing the weeds. Introduce the concept of herbicides and the efficiency they offer. Ask them again which ones or combinations they would choose, and why. Build on the responses they provide to these questions. If they do not present trade-offs between efficiency and human health and environmental quality issues, introduce the pros and cons of different approaches. Explain the possible unintended consequences of herbicides (farm worker and consumer poisoning, water, soil, and air resource contamination, wildlife and ecosystem damage). Present these consequences as reasons cited farmers who do not use synthetic herbicides (e.g., organic farmers) for why they are willing to sacrifice a degree of efficiency for personal and society-wide human health and environmental benefits (safe working environments, clean food, air, and water, as well as conservation of wildlife and ecosystems).
 3. Ask the students if any of them considered using hand labor as their way of managing the weeds. Explain the financial, time, management, and human health challenges

hand labor can presents to farms and farm workers. Discuss the consequences on workers' human health when engaging in extreme or protracted physical labor, such as hand weeding and hoeing for forty hours or more per week, often in high temperatures. Explain that an approach to avoiding both chemical herbicides and protracted routine hand laboring has been to diversify the types of crops and animals being raised on a farm. The greater the difference between the weeding demands of crops and the greater the number of distinct labor responsibilities there are in a farming operation, the less likely farm laborers will face risk prone routines. It is the protracted repetition of certain, often seemingly benign, physical postures and activities such as hoeing, that often lead to farm worker injury. There are no easy solutions to the challenges of weed management when facing the trade-offs and costs between toxic chemical exposure and physical injury, particularly with large scale plantings of single crops.

Discussion and Reflection (10 minutes)

Students are encouraged to consider what weed management activities are used when producing the food they choose to eat and purchase.

- *How is their own food grown?* While still on the farm, ask students if when they buy food such as French fries, or chips and salsa do they ever wonder about how the potatoes, corn, tomatoes, cilantro, and onions were grown? Was it grown in a way that was safe for the consumer, the farmers and farm workers who grew it, and the environment? Have you ever seen signs in the store about how the food was grown and whether or not the farmer used pesticides? What did these signs look like? What did they say?

Students are also encouraged to inquire about the trade-offs of different weed management approaches practiced at home and on their school campuses.

- *Weeds at Home and School:* Ask students if any of them have weeded at home, in a garden or ornamental landscape. How have they managed weeds in these situations? Ask them if they know how the weeds are managed at their school.
- Have students interview their parents and school grounds managers and ask them why they choose the weeding methods they use.
 1. What are the main problem weeds they face?
 2. What approaches are they using in managing these weeds?
 3. How do they decide between different management methods?
 4. Do they see trade-offs between using chemical herbicides and physical labor to deal with weeds?
 5. What do they see as the advantages and disadvantages of different approaches?

Please find included in the activity guide photo weed I.D. sheets. These are single page sheets with pictures of weeds common to the farm, in the various stages of their life cycles. You will also find a blank I.D. sheet template to use in making additional sheets for some of the important weeds found on your farm.

Weeds photos were sourced from the University of California, Integrated Pest Management Guidelines: How To Manage Pests of Agriculture
<http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html>.

Lambsquarters (*Chenopodium album*)

(photos from UC Statewide IPM Project, © Regents, University of California)



Mature Lambsquarters plant



Lambsquarters flowers



Lambsquarters seedling

Redroot Pigweed (*Amaranthus retroflexus*)

(photos from UC Statewide IPM Project, © Regents, University of California)



UC Statewide IPM Project
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Mature pigweed plants



Pigweed seedlings



UC Statewide IPM Project
© 2000 Regents, University of California

Pigweed flower with seeds



UC Statewide IPM Project

Pigweed flowers

Yellow Nutsedge (*Cyperus esculentus*)

(photos from UC Statewide IPM Project, © Regents, University of California)



Yellow Nutsedge flowering plant.



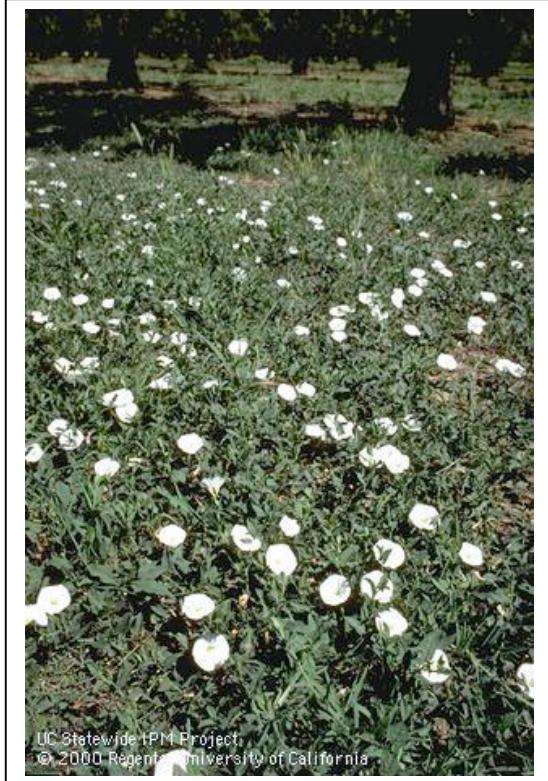
Nutsedge seedling



Nutsedge tubers.

Field Bindweed (*Convolvulus arvensis*)

(photos from UC Statewide IPM Project, © Regents, University of California)



UC Statewide IPM Project
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Mature bindweed



Bindweed seedling



UC Statewide IPM Project
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Bindweed flowers

Bindweed growing from rhizomes

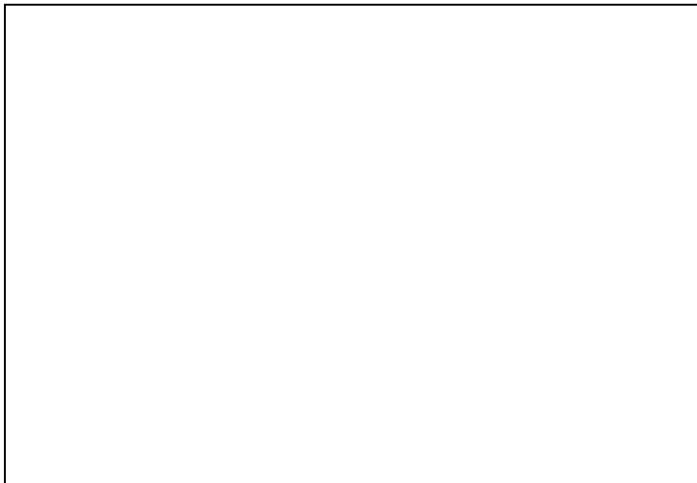


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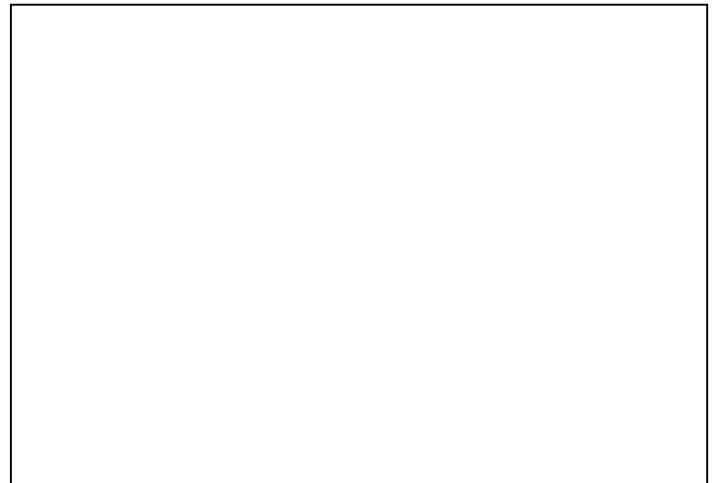
Common Weed Name (*Latin Name*)

(photos from UC Statewide IPM Project, © Regents, University of California)

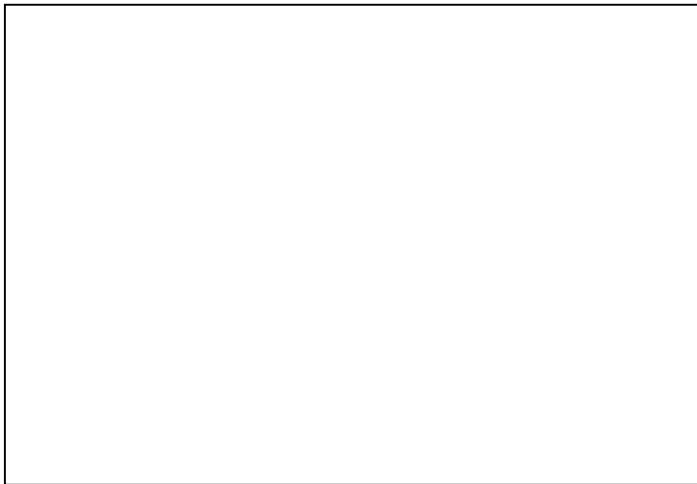
Create your own weed information sheet by inserting pictures from
http://ipm.ucdavis.edu/PMG/weeds_common.html



Picture of mature weed plant



Weed plant's flowers



Seedling stage



Plant's seeds or other important plant features