

Lesson Plan: Reducing Food Loss Starting on the Farm

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Grade Level(s)

9 - 12

Purpose

Reducing food waste and loss requires commitment from the entire food chain, from farmers in the field all the way to consumers in the home. The conversation on food loss also creates an opportunity to discuss why and how farmers use pesticides to grow more efficiently. This lesson plan provides students with concepts to help them both reduce waste as a consumer and learn how farmers use pesticide technology to prevent damage to crops.

Supplementary Materials

- Vocabulary
- Facts
- Resources

Activities

Interest Approach and Activity 1: Loss and Waste Along the Food Chain (1.25 hours)

- Discussion questions
- Handouts (5)

Activity 2: Having The Talk on Crop Protection (1 hour)

- Need projection screen or Internet/computer
- The Talk videos (3)
- Blog article by Kacie Lockett of Lockett Farms
- Master's in Modern Ag Specialty Certification: Reducing Food Loss

Activity 3: School Food Waste Audit (1-2 weeks)

- Brings students outside of the classroom for a collaborative school-wide effort
- Need to organize with cafeteria staff/school nutritionist or can do individually at each lunch period

Vocabulary

Definitions taken from the United Nations Food and Agricultural Organization report, [*Global Food Losses and Food Waste: Extent, Causes and Prevention*](#). 2011. Contextual questions written by CropLife America.

What is Food Loss and Waste?

Food Loss: Food losses refer to the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption. Food losses take place at production, postharvest and processing stages in the food supply chain (Parfitt et al., 2010). Food losses occurring at the end of the food chain (retail and final consumption) are rather called “food waste”, which relates to retailers’ and consumers’ behavior. (Parfitt et al., 2010).

Food Waste: “Food” waste or loss is measured only for products that are directed to human consumption, excluding feed and parts of products which are not edible. Per definition, food losses or waste are the masses of food lost or wasted in the part of food chains leading to “edible products going to human consumption”. Therefore, food that was originally meant to human consumption but which fortuity gets out the human food chain is considered as food loss or waste even if it is then directed to a non-food use (feed, bioenergy...). This approach distinguishes “planned” non-food uses to “unplanned” non-food uses, which are hereby accounted under losses.

When Does Food Loss and Waste Occur in the Production of Vegetable [both for consumption and for use in products]?

Agricultural production: losses due to mechanical damage and/or spillage during harvest operation (e.g. threshing or fruit picking), crops sorted out post-harvest, etc.

Post-harvest handling and storage: including losses due to spillage and degradation during handling, storage and transportation between farm and distribution.

Processing: including losses due to spillage and degradation during industrial or domestic processing, e.g. juice production, canning and bread baking. Losses may occur when crops are sorted out if not suitable to process or during washing, peeling, slicing and boiling or during process interruptions and accidental spillage.

Distribution: including losses and waste in the market system, at e.g. wholesale markets, supermarkets, retailers and wet markets.

Consumption: including losses and waste during consumption at the household level. Animal commodities and products: Agricultural production: for bovine, pork and poultry meat, losses refer to animal death during breeding. For fish, losses refer to discards during fishing. For milk, losses refer to decreased milk production due to dairy cow sickness (mastitis).

Facts

I. How big is the problem of food waste?

- In the journey from seed to plate, food loss occurs at many points:
 - In the field (weeds, diseases)
 - Post-harvest in storage (mold, rot)
 - In the separation of food for transport (due to consumer quality preferences, such as regarding color and size)
 - In transport (mold, rot)
 - At the grocery store (mold, rot)
 - In the kitchen at home or in a restaurant
 - After meal-time
- About one-third of the food produced in the world for human consumption every year is lost or wasted — that's 1.3 billion tons.¹
- Globally, annual food loss and waste stands at: 30% for cereals; 40-50% for root crops, fruits and vegetables; 20% for oil seeds, meat and dairy; and 35% for fish.²
- In industrialized countries, more than 40% of food loss happens at the retail and consumer levels.³
- The global food surplus increased overall between 1965 and 2010 from 310 extra kilocalories per person per day to 510 extra kilocalories, with the greatest surplus growth rates generally observed in developed nations.⁴
- If we were able to save a quarter of the food currently lost or wasted around the world, it would be enough to feed 870 million hungry people.⁵
- Food waste/loss estimates do not include the amount of *potential food loss*, or crop losses, from pests, weeds and disease from crops that are not yet harvested.
 - The UN Food and Agricultural Organization (FAO) estimates that, globally, 20-40% of crops are lost each year to pests and disease.⁶
 - In a 2006 study, scientists from the Institute for Plant Diseases in Bonn, Germany estimated that pests alone could potentially cause the loss of half of the world's wheat crops.⁷

¹ UN FAO, [Key facts on food loss and waste you should know!](#)

² Ibid.

³ Ibid.

⁴ UN FAO, [Food wastage imprint: Impacts on natural resources](#). 2011.

⁵ UN FAO, [Key facts on food loss and waste you should know!](#)

⁶ UN FAO, [Keeping plant pests and diseases at bay: experts focus on global measures](#). March 16, 2015.

⁷ Institute for Plant Diseases, Rheinische Friedrich-Wilhelms-Universitaet Bonn. [Crop losses to pests](#). The Journal of Agricultural Science, Volume 144, Issue 01. February 2006, pp 31-43.

- The 2006 study also found that weeds produced the highest potential loss at 34%, with losses due to animal pests at 18% and losses due to pathogens (e.g., bacteria or virus causing disease) at 16%.⁸

II. What are the effects of food waste and crop loss?

- Food and crop loss wastes resources, including water, land, energy, labor and capital.
- “The agricultural emissions associated with surplus food more than quadrupled between 1965 and 2010, from 130 million tons of carbon dioxide equivalent to 530 million tons. These estimates don’t include the carbon emissions associated with energy use, so the reality is that the food waste’s carbon footprint was even higher — more like 3 billion tons, going by the FAO’s previous research.”⁹
- Food and crop loss on the farm and in storage translate into lost income for farmers and into higher food prices for consumers.
- A report from the UN FAO estimates that “the direct economic consequences to producers of food wastage (excluding fish and seafood) run to the tune of \$750 billion annually.”¹⁰

III. How can we reduce food and crop loss in agriculture?

- Through the responsible use of crop protection products, growers can minimize the damaging effects of crop diseases, weeds and pests.
- Precision agriculture technologies help growers use inputs and resources more efficiently, increasing productivity in an eco-conscious way.
- Methods of improving the shelf-life of produce include:
 - Growers can responsibly use pesticides and other crop protection strategies to prevent damage to produce.
 - Food processors can employ technologies such as irradiation, calcium treatments, warm water dips, and modified atmosphere packaging.¹¹
 - Food manufacturers/processors can make their transportation systems as efficient as possible.
 - Consumers/restaurants should store produce correctly, whether that be within a storage container in the refrigerator or on the counter out of the sunlight.
 - Consumers/restaurants should wait to wash their produce until close to when it will be consumed.

⁸ Institute for Plant Diseases, Rheinische Friedrich-Wilhelms-Universitaet Bonn. [Crop losses to pests](#).

⁹ UN FAO, [Food wastage imprint: Impacts on natural resources](#).

¹⁰ UN FAO, [Food waste harms climate, water, land and biodiversity – new FAO report](#). September 13, 2013.

¹¹ Prakash, Anuradha and Foley, Denise. [Improving Safety and Extending Shelf Life of Fresh-Cut Fruits and Vegetables Using Irradiation](#). American Chemical Society. 2004.

Resources

A number of organizations are working to reduce food waste at many points of the food production spectrum. Many provide tips on how consumers can reduce the amount of food they waste at home.

- [With or Without Pesticides?](#) – From the European Crop Protection Association
- [Food Waste Reduction Alliance](#)
- [ReFED](#)
- [Sustainable Management of Food](#) (which includes the Food Recovery Hierarchy) – From the U.S. Environmental Protection Agency
- [Let's Talk Trash](#) – From the U.S. Department of Agriculture
- [Save the Food Campaign](#) – From the Ad Council and the Natural Resources Defense Council
- [Harvard Food Law and Policy Clinic](#)

Interest Approach and Activity 1: Loss and Waste Along the Food Chain

(1 hour)

Begin the first activity with a few conversation starters.

- Who has grown some of your own food? What did you learn? Were there any surprises?
- Why do you think so much food is wasted in America?¹²
- Why is it important not to waste food? Consider: ethics, environment, economy, etc.

Then, pass out the [diagram](#)¹³ on when food loss/waste occurs throughout the food production chain. Discuss the different stages of the food chain and ask how students think food loss could be reduced at different steps. Encourage a brainstorm session.



Next, distribute the four handouts below produced by members of the Food Waste Reduction Alliance¹⁴. Ask the students to divide into groups and create a 1-page flyer with five facts about reducing food waste at home (consumer level).

- [Food Manufacturers and Food Waste](#)
- [Grocery Stores and Food Waste](#)
- [Restaurants and Food Waste](#)
- [Reducing Food Loss Starting on the Farm](#)¹⁵

As an exit activity, ask the students to write a mock tweet with a hashtag regarding what they would say about food waste, where food loss occurs, or any other thoughts regarding food loss.

¹² [Teaching kids to waste less food](#) by Elise Warner and Jonathan Bloom, posted on MSNBC (4/6/15)

¹³ United Nations Food and Agricultural Organization, [Food loss/waste](#).

¹⁴ [Food Waste Reduction Alliance](#)

¹⁵ [CroLife America](#)

Activity 2: Having the Talk on Crop Protection

(45 minutes)

Prepare your projection screen. Go to www.GiveACrop.org. Play, *Wild Oats*. After playing, ask a few discussion questions:

- What is crop protection?
- What other things do we protect ourselves from? (sun lotion, bug spray, medicine/anti-biotics, car insurance, door locks, security guards, etc.)
- Why should farmers use crop protection if it may be risky?
- Name other items that we use or activities we do every day that carry a level of risk (shampoo, soap, driving a car, using electricity, etc.)

Play two more videos:

- *Backyard Barbeque*
- *Office Pest*

Handout the blog article, [Reducing Food Loss on the Farm and the Kitchen Table](#), by Kacie Lockett of Lockett Farms or direct students to read it online.

Then, ask the students to test their new knowledge gained from activities 1 & 2 by completing the online quiz: [Master's in Modern Ag Specialty Certification: Reducing Food Loss](#) (passkey: MMA2016). Students can learn more about crop protection and sustainable agriculture by completing the six other available quizzes available once they log in ([use this web address for returning users](#)).

- Master's in Modern Ag
- The Talk
- Supporting Soil Health
- Founders of Modern Ag
- Protecting Our Pollinators
- Lab to Label
- Growing Nutritious Produce

Activity 3: School Food Waste Audit

(1-2 weeks)

Taken from [Teaching kids to waste less food](#) by Elise Warner and Jonathan Bloom, posted on MSNBC (4/6/15).

Lesson:

Habits are formed early in life. From their first school lunch experiences many children learn to throw away part or all of their lunches. Most students aren't taught that wasting food has consequences beyond a parent worried they aren't getting the nutrients they need. There are many lessons students can learn here about the environment, society, the economy and ethics.

Sample script:

Students are notoriously picky eaters. But with one billion people who are hungry on our planet (including in each of our communities) we can do a better job of not wasting food.

What are some of the reasons that you throw away food that could be eaten?

What are some ways you can think of that we can reduce the amount of food we waste at school? (Students can take an active part in packing foods they'll eat. They can request portion sizes they can manage.)

Talk with students about where the wasted food will go and why that's harmful. (Landfill. Greenhouse gas emissions. Serious stuff.)

Activity:

- Work with your school's cafeteria to weigh the food that is thrown away at the end of each lunch period.
 - *As an alternative, students can track their individual lunch waste.*
- Next, have students catalog what kinds of food are being wasted.
- At the end of one or two weeks have the students report their findings (in a report or chart).

Find ways to challenge each class to try to lessen the amount each week. Combine lessons of nutrition, language arts, science and math. If students are interested in doing something about this work, they can contact the non-profit Food Bus or partner with a local food relief agency to establish a "food rescue" operation.

Sample Report for the School Waste Audit

Date/Week	What is being thrown away? (Qualitative) <i>Discover this visually or through interviews with cafeteria staff</i>	How much does it weigh? (Quantitative) <i>Use a scale</i>
Week 1: January 9	Students didn't eat the broccoli or carrots	120 lbs.
Week 2: January 16	Lots of lettuce and carrots, again	130 lbs.
Week 3: January 23	More salad items, onions.	125 lbs.
Week 4: January 30	Kale! And more onions and carrots.	145 lbs.



Conclusions:

- Students don't like to eat vegetables.
- The average weight of wasted food is 130 lbs. per week.
- We should start a school-wide campaign to encourage students to eat more vegetables. We could run a contest to weigh everyone's plate at the end of a lunch period to see who has the least amount of food waste.