NO PREP

Agriculture & Food Production

Feeding the Future

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

Agriculture & Food Production: Feeding the Future

Geographic Foundations of Farming

Agriculture relies heavily on geography—climate, soil, topography, and water availability determine what crops flourish where. In temperate zones with fertile loess soils, grains like wheat and barley dominate, while tropical climates support rice paddies and oil palm plantations. Mountainous regions may specialize in vineyards or tea, adapting to sloped terrain and microclimates. For high-school students, mapping major crop belts illustrates how physical factors shape human livelihoods: for example, the North American Corn Belt thrives on deep, well-drained soils and summer rainfall, whereas the Nile Delta's irrigation network

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Intensive vs. Extensive Agricultural Systems

Agricultural methods fall on a spectrum from intensive to extensive. Intensive agriculture maximizes output per hectare using high-yield seeds, fertilizers, and irrigation, as seen in Dutch greenhouse horticulture or California's Central Valley orchards. Such systems demand significant inputs and labor but produce large harvests on limited land. Extensive agriculture spreads low inputs (minimal irrigation or chemicals) over large areas, common in Australia's sheep grazing or Brazil's cattle ranches. Although less productive per hectare, extensive farms capitalize on vast land availability and lower labor costs. Each approach carries trade-offs. Intensive

farms can deplete soils, pollute waterways with agrochemicals, and require energy-intensive infrastructure. Extensive farms may lead to deforestation, habitat loss, and greenhouse-gas emissions from methane-producing livestock. Students can compare yields, input costs, and environmental footprints to evaluate which method suits specific regions and policy goals. Table 1: Comparison of Agricultural Systems

The Green Revolution & Agri-Tech Innovations

In the mid-20th century, the Green Revolution transformed agriculture through dwarf wheat and IR8 rice varieties that responded robustly to fertilizers and irrigation. Between 1960 and 2000, countries like India and Mexico tripled cereal yields, averting famines and supporting population growth. High-school learners can debate how yield gains reduced food insecurity yet intensified demands for water and synthetic inputs. Today's agri-technology moves beyond seed genetics to precision farming, drone surveys, and AI-driven analytics. Sensors measure soil moisture and nutrient levels, enabling farmers to apply water and fertilizer precisely where needed. Vertical farms in urban centers stack LED-lit trays of greens, minimizing land use and transport. Startups develop gene-edited crops resilient to drought and pests. By exploring these innovations, students see how technology seeks to feed a projected 10 billion people while addressing environmental limits.

Key Information

System	Key Features	Example
Intensive	High inputs, high yields, small land area	Dutch hydroponic tomato farms
Extensive	Low inputs, low yields per hectare, large land	Australian sheep stations

Case Study Excerpt: The Rise of Rice Intensification in Madagascar

In the 1990s, many smallholder farmers in Madagascar struggled with low rice yields—averaging less than two tons per hectare—due to traditional transplanting methods and limited access to fertilizer. A grassroots initiative introduced the System of Rice Intensification (SRI), encouraging farmers to plant younger seedlings singly, space them further apart, and manage water more flexibly rather than keeping fields continuously flooded. Local agricultural extension agents trained communities in organic soil amendments, alternate wetting and drying, and careful weed control. Within five years, participating villages saw yields soar to four–five tons per hectare—double or triple previous outputs—using 80 percent less seed and up to 50 percent less water. Women, who formed most of the labor force, reported spending less time knee-deep in paddies and more on value-added tasks like rice polishing and local markets. Despite initial skepticism, Madagascar's Ministry of Agriculture adopted SRI nationally, collaborating with NGOs to scale training programs. While challenges remain—such as labor intensity and the need for continued technical support—the Malagasy example demonstrates how low-cost, knowledge-based practices can revolutionize productivity and livelihoods without heavy chemical reliance.

1. What key practice of SRI helped Madagascar farmers reduce water use?

2. How did SRI adoption impact women's roles in rice production?

Multiple Choice

1. Which factor most limits extensive cattle ranching?

    a) Livestock feed quality

    b) Vast land requirements

    c) High fertilizer costs

    d) Low land availability

2. The original Green Revolution relied heavily on:

    a) Vertical farming

    b) Organic composting and manure fertilizers

    c) High-yield seed varieties

    d) Mechanized drones

3. Precision agriculture primarily aims to:

    a) Increase manual labor

    b) Expand farmland area

    c) Eliminate smallholder farms

    d) Reduce input waste

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Drone crop monitoring	A) Uses satellites to plant seedlings
2. ___ LED-lit vertical farms	B) Controls water levels by alternating wet/dry cycles
3. ___ Alternate wetting and drying (AWD)	C) Applies fertilizer only where sensors detect needs
4. ___ Variable-rate fertilization	D) Aerial surveys to assess plant health
5. ___ Rice transplanting	E) Grows crops in stacked indoor trays

Fill-in-the-Blank

1. The Green Revolution introduced _____ varieties that responded to fertilizer.

2. Precision farming reduces _____ by applying inputs only where needed.

3. Extensive agriculture often uses _____ per hectare compared to intensive systems.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain one environmental benefit and one drawback of SRI practices.

_____

_____

_____

2. Describe how precision agriculture can help smallholder farmers.

3. In what way does vertical farming address geographic constraints?