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Kansas Foundation for AGRICULTURE IN THE CLASSROOM

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Course:	Biology 9-12	**Unit:**	Vertical Gardening - Agriculture Careers
Lesson Title:	Cashing in on Cash Crops: The connection between food production and consumer demand		
Estimated Time:	3 class periods of 40 minutes		

Objectives:

1) Describe the effects of historical events on the global wheat market
2) Identify important characteristics of agricultural products that impact consumer choice
3) Read and evaluate food package labels

Equipment Needed:

Projector or student individual devices to show https://www.teachkyag.org/lessons/wheat-presentation-poster

Individual electronic devices for students to read about challenges wheat growers face

Plate or tray to place wheat samples on

Supplies Needed:

Paper or device for students to do essential question

6 copies for each station of Wheat Type Cards

Samples for each student of each type of wheat (available to purchase from National Ag in the Classroom here)

If students do not

Accessibility Options

Students can access information visually through online videos with subtitles and auto-translations.

Utilize Speech-to-Text and text-to-speech add-ons for reading/listening/writing support (Updated 7/17/23)

Multisensory resources: wheat, grocery store products, food science lab ingredients

For more suggestions, please visit:
https://www.washington.edu/doit/equal-access-science-and-students-sensory-impairment

Instructor Directions & Estimated Time	Procedures

Day 1 40 minute period	Researching and understanding what crops grow around the world and for what reasons
Day 2 40 minute period	Choosing crops based on prior knowledge
Day 3 40 minute period	Implement what they have learned in previous days and make bread or tortillas.

No.	9-12 Next Generation Science Standards		
HS-LS 2-5	Matter and Energy in Organisms and Ecosystems: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon in the biosphere, atmosphere, hydrosphere, and geosphere.		
	Disciplinary Core Ideas	Science and Engineering Practices	Cross-Cutting Concepts
	LS2.B: Cycles of Matter and Energy Transfer in Ecosystem	Developing and Using Models	Systems and System Models

No.	9-12 National Agriculture Literacy Outcomes
T1. 9-12 c&f	c. Discuss the scientific basis for regulating the movement of plants and animals worldwide to control the spread of potentially harmful organisms (e.g., invasive species and disease-causing organisms such as foot and mouth disease and avian and swine flu) as well as the methods of control in place (state, national, and international policies, economic incentives) f. Evaluate the various definitions of “sustainable agriculture,” considering population growth, carbon footprint, environmental systems, land and water resources, and economics
T2. 9-12 c	c. Discuss reasons for the government’s involvement in agricultural production, processing, and distribution
T3. 9-12 d	d. Evaluate the cost of food in the United States relative to other countries
T4. 9-12 a	a. Correlate historical events, discoveries in science, and technological innovations in agriculture with day-to-day life in various periods

Vocabulary	
Bumper Crop	an unusually large harvest of a certain crop
Bushel	a measure of capacity equal to 64 US pints used for dry goods
Maize	an alternative word used about corn
Legume	any plant from the Fabaceae family that would include its leaves, stems, and pods. One example would be soybeans.

Careers Mentioned	
Data Analysis	Responsible for using their knowledge of data processing software and business development strategies to provide sound business decisions to company executives.
Food Scientist	Work to discover or develop new foods and good manufacturing methods and monitor existing food processing.
Nutritionist	A professional who works with clients to give individualized food and nutrition guidelines that help clients work towards a healthier lifestyle.

It may need 2 weeks after planting to start collecting and analyzing data (journal- how many seeds are up, are just the cotyledons up or the true leaves as well). This is an ongoing activity.

Day 1

Day 1 Essential Question: How do we choose plants that benefit the environment, human health, and the economy?

1) Bellringer: What food products are made from wheat? List 3 or more. (Show students the wheat infographic from https://www.teachkyag.org/lessons/wheat-presentation-poster) (3 minutes)

2) Connection to the previous lesson: (5 minutes)

Wheat has played an important role in United States history. Remember the Dust Bowl? "Rising wheat prices in the 1910s and 1920s and increased demand for wheat from Europe during World War I encouraged farmers to plow up millions of acres of native grassland to plant wheat, corn, and other row crops. However, as the United States entered the Great Depression, wheat prices plummeted. In desperation, farmers tore up even more grassland in an attempt to harvest a bumper crop and break even" (https://www.history.com/topics/great-depression/dust-bowl)

Various global events still affect grain markets today. Read the following article and answer the questions below as you read.
Wheat in the news today: European wheat exports affected by war in Ukraine (Very nice multilingual, color graphics) 15 minutes
https://www.consilium.europa.eu/en/infographics/ukrainian-grain-exports-explained/. Ask students to answer the following questions as they read the article:
1. How has the war in Ukraine affected wheat exports?
2. What has been the effect of the war in Ukraine on the global wheat market?
3. What types of nations receive the majority of wheat exports from Ukraine?
4. What types of nations have been most affected by global wheat market changes?
5. What is the definition of a developing nation? What is the definition of a developed nation?
6. What stood out to you the most in this article?

Wheat is one of the top four staple crops in the world (https://croplife.org/news/beyond-the-big-four-staple-crops-around-the-world/). Six main types of wheat are grown in the world, and today, you will be acting as crop consultants to determine what wheat type would work best for growing here in Kansas. There are six wheat stations you will need to visit. Take notes on the different types of wheat in your crop notes chart provided.

3) Wheat stations (Adapt from National Ag in the Classroom lesson (question 5): Growing a Nation Era 3: Prosperity and Challenges https://agclassroom.org/matrix/lesson/539/

Set up 6 stations with color copies of the 6 **classes of wheat** at each station (Handout link: https://cdn.agclassroom.org/media/uploads/2019/05/31/Classes_of_Wheat_1.pdf)

In their Crop Notes chart, they each need to record 1) the type of wheat, 2) where it is grown, 3) the Nutritional content, 4) the Products it is used to make 5) where it is exported to

4) Discuss: If you were a **crop consultant** (job title) and you needed to choose the type of wheat you wanted to grow, which type would you choose and why? What social, economic, and environmental factors would you consider? What information do you still need to make an informed decision? (Brainstorm as a class)

5) Research: Use the Kansas Wheat Sector report to identify 2 or more challenges that wheat growers face.
https://agriculture.ks.gov/docs/default-source/ag-growth-summit/january-2018-documents/wheat-sector.pdf

The BBC article "Bread's environmental costs are counted" discusses the environmental impacts of growing wheat to make bread. https://www.bbc.com/news/science-environment-39106180

Add your findings to page 2 of your **Crop Notes Chart**

Day 2

Day 2 Essential Question: What do consumers need to know about agricultural products to make well-informed decisions?

Bellringer: What is important to you when you choose what kind of food to buy at the grocery store? Rank these factors in order of importance from 1:= most important to 5= least important (Example: Appearance, flavor, price, nutritional content, locally sourced (On Lesson 6 slides)

Engage: Set up 10 stations with products students must choose from for purchasing. Do not give them the list of prices ahead of time. Why did you choose the items you did? What do the labels on the products mean? After they have made their selections, tell students the prices of the products and have them total their grocery lists. You may use printed labels from the following slide deck if you so choose.

See National Ag in the Classroom Lesson: **Looking under the Labe**l (Estimated time: 1 hour- could easily take 2 days if you choose one of the extension activities)
https://agclassroom.org/matrix/lesson/655/ (non-GMO milk video, activity 1, activity 2, activity 3,

Purpose: Students evaluate food package labels, determine their meaning, and use the *Claim, Evidence, and Reasoning* model to determine the value of the label in relation to food production practices, nutrition, health, and food safety. Students will engage in critical thinking to recognize the impact of food package labels in relation to marketing, consumer perceptions of food, and farming practices.

Revisit students' grocery lists. Are there any changes you would make to your purchases? Why or why not?

Lesson 6 Vocabulary slides:
https://docs.google.com/presentation/d/1M6rQ9uFyj52WixPKylZi8zTIc1egh5SGq0oqQInp6II/edit?usp=sharing

Here's a link to the shopper's guide:
https://docs.google.com/document/d/1lC2h7hhqB_5uCBgme5_Das9KeDctsov06KQJkJ8ozHI/edit?us

p=sharing

Supplemental sources:
How to read food and beverage labels
https://www.nia.nih.gov/health/how-read-food-and-beverage-labels

Labels Unwrapped https://labelsunwrapped.org/labels-101
The Labels Unwrapped project was launched to address the frustration and confusion caused by food labels. Laws and regulations that govern the labeling of food products are complex and, in some instances, ambiguous. Because everyone eats food every day, the creators of this site wanted to unwrap the law behind the labels on various types of food products and provide an accessible informational resource for anyone who wants to better understand the language and imagery that can both inform and confuse consumers. (Very informative, but a bit text-heavy)
FDA food labeling guide (available in multiple languages)
https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-food-labeling-guide

Graphs demonstrating consumer preference for healthy-sounding food labels.
https://www.ers.usda.gov/amber-waves/2022/march/consumers-interpretation-of-food-labels-with-production-claims-can-influence-purchases/

Misleading food labels (list with countermoves created by a physician group)
https://www.gaplesinstitute.org/5-misleading-food-labels/

Make a list of terms (with pictures) for a classification/sorting activity- identify products and prices and have students total grocery bills (hide prices until the end) cheap vs. expensive, quality, attractiveness, ingredients, labels (Discussion questions: how would your choices have changed if you were on a budget vs someone who has dietary restrictions?)
Organic
Gluten-Free
Natural
Whole grain vs. 100%
Non-GMO (There are NO GMO oranges!!)

Research: What are the crops that are actually GMO? Corn, soybeans, canola, papaya, cotton, potato, alfalfa, summer squash, pink pineapple, apple, sugar beet

Activity: ID the GMO

Website with multilingual video:
https://www.fda.gov/food/agricultural-biotechnology/gmo-crops-animal-food-and-beyond (Save GMO for biotechnology and build background knowledge of DNA)

Day 3

Bellringer: What type of wheat or corn flour food do you know of that could be made quickly and

easily?

Divide students into groups of three or four. Each group will choose a recipe they will make that uses wheat or corn flour. If you have ovens available, students could choose recipes that require ovens. If only electric skillets are available, students will be limited to items such as tortillas or pancakes. Students can either find their recipes or choose from the list below, or the teacher can choose which recipes to use based on available ingredients.

Whole Wheat Tortilla Recipe
Flour Tortilla Recipe
Corn Tortilla Recipe
Good Old-Fashioned Pancakes Recipe
100% Whole Wheat Pancakes Recipe
Griddle Corn Cakes
Frying Pan Bread
Fried Bread

Exit Ticket: Have students write up a list of needed ingredients.

Main topics teachers should know:

In order to make informed choices about what agricultural products to use, we must know more about them and the purpose they serve. Legumes are plants like beans, peas, lentils, and soybeans in which they have to ability to fix nitrogen into the soil. This is done through a symbiotic relationship between bacteria and their roots. This process enriches the soil with nitrogen which then reduces the need for synthetic fertilizers. Not only does this make the soil more healthy, it provides a rich protein source. Maize, commonly known as corn, is one of the most widely grown crops in the world. These versatile crops are used for food, animal feed, biofuel, and industrial products. Corn is often grown in rotation with other crops, which helps improve the soil and manage pests and weeds. Different varieties of corn can be drought or pest-resistant to enhance yield and sustainability. A bumper crop is a huge harvest of a particular crop, which can boost the profit, but can also lead to a surplus, which can drop the price. Diversifying crop rotation can help manage the risk that can come with bumper crops. To measure these crops we use bushel, which is a unit of measurement of agricultural products, specifically grains, corn, wheat, and soybeans. The unit of measure is based on volume rather than weight to standardize trade and pricing.

Data Analysts, Food Scientists, and Nutritionists all play vital roles in understanding and optimizing the use of agricultural products. Data Analysts collect and interpret data on crop yields, soil health, and market trends, helping farmers make informed decisions about crop rotations, planting strategies, and risk management for bumper crops. Food Scientists focus on improving the quality, safety, and sustainability of agricultural products, such as developing new uses for legumes or creating nutrient-rich food products from maize. Nutritionists analyze the dietary value of crops, like the protein in legumes or the carbohydrates in corn, to recommend their optimal use in human and animal diets. Together, these professionals ensure agricultural products are grown efficiently, processed sustainably, and utilized to enhance global food security and nutrition.

- Legumes and Pulses – The Nutrition Source
- 6 Classes of Wheat and Their Uses
- Organic vs. Conventional Farming
- Grain-Free vs. Gluten-Free: What's the Diff? – Nature's Path
- USDA Certified Organic Versus Non-GMO Foods: Key Things to Know - Pacific College
- The Difference Between GMO & Non-GMO - From Harvest to Consumption
- Whole Grain vs. Whole Wheat: What's the Difference?

Suggestions for instruction:

Have students choose their recipes based on your available resources. If you only have electric skillets available, have students choose recipes that can be cooked in skillets. If your class periods are shorter, have students find recipes that can be made within the timeframe of your class. If you don't have a lot to spend on ingredients, have students pick recipes that do not use many ingredients or ingredients that tend to be expensive.

Kansas Department of Agriculture (KDA)

The Kansas Department of Agriculture (KDA) is the nation's first state department of agriculture. The agency is devoted to the total support of agriculture in Kansas. The department works for the entire Kansas agriculture sector, including farmers, ranchers, food establishments, and agribusinesses. The department is dedicated to providing support and assistance to make Kansas businesses successful and encouraging more farms, ranches, and other agriculture businesses to expand or relocate to Kansas.

KDA also fulfills its statutory responsibility of regulating business functions by state law. The department works to ensure businesses know what laws affect them and how they can ensure they comply with those laws. In this process, the department aims to minimize excessive rules and regulations.

The Kansas Department of Agriculture is committed to a balanced approach of: serving Kansas farmers, ranchers, agribusinesses, and the consumers/customers they serve; providing an environment that enhances and encourages economic growth of the agriculture industry and the Kansas economy; and advocating for and promoting the agriculture industry, the state’s largest industry, employer and economic contributor; while helping to ensure a safe food supply, protecting natural resources, promoting public health and safety, protecting animal health, and providing consumer protection to the best of our ability.

The Kansas Department of Agriculture will achieve its vision and mission by: creating a “best-in-state plus” work force and a work environment with a positive culture and attitude; working diligently to make the agency more innovative and efficient while streamlining program operations; fulfilling and upholding statutory and regulatory obligations fairly, transparently, efficiently and effectively; working with industry partners to guarantee the interests of Kansas and the agriculture industry are considered in state and federal policy decisions; providing customer support, timely responsiveness, educational resources, and critical information to all Kansans; broadening the understanding and appreciation of agriculture and its economic contribution amongst Kansas citizens; providing support and assistance to help make Kansas businesses more successful, grow rural communities, expand markets for Kansas agricultural products, level the playing field, grow the agricultural workforce, and encourage more farms, ranches and other agriculture businesses to expand in or relocate to Kansas; and being a model state agency.

In order to achieve our agency goals and maintain an achievable focus, the following objectives are considered top priority: improving customer service and compliance education for all customers and licensees; streamlining and automating internal and external systems and continuing to identify opportunities for program and agency efficiencies in daily business activities; performing daily responsibilities effectively and efficiently with a focus on customers served and cross training when appropriate; evaluating and adjusting program, division and agency structure to continually improve effectiveness and efficiency; eliminating unnecessary and outdated regulations and/or agency activities; enhancing internal communications and professional development opportunities for agency staff; recruiting and retaining high quality employees — the right people, doing the right thing, with the right attitude; continuing to build upon a commonsense policy and regulatory agenda and influencing federal policy issues in accordance with industry needs and interests; growing agriculture in the state, eliminating barriers to growth, developing workforce and building marketing activities in-state, out-of-state and globally; developing strategic partnerships with Kansas State University and other potential partners to better serve Kansans and the agriculture industry; and advocating for agriculture at all levels and providing industry outreach.

KDA is organized into a variety of divisions and programs that perform different administrative, marketing, regulatory, and other services. Read more about KDA divisions and programs from the list below.
https://agriculture.ks.gov/docs/default-source/documents---office-of-the-secretary/kda-divisions-amp-programs.pdf?sfvrsn=68b4c1_8

Careers:

Data Analyst:

Description: A Data Analyst is responsible for using their knowledge of data processing software and business development strategies to provide sound business decisions to company Executives. Their duties include collaborating with other data professionals to extract data figures, creating reports based on their findings, and monitoring key performance indicators (KPIs) to determine business initiatives' success.
Data Analysts collect data, such as sales numbers or market research, to help companies make the right decisions. This work encompasses several duties and responsibilities, including working with executives and other business leaders to identify opportunities for improvement, create reports for internal teams and/or external clients, collaborate with team members to collect and analyze data, use graphs, infographics, and other methods to visualize data, establish KPIs to measure the effectiveness of business decisions, structure large data sets to find usable information, work with a team of analysts and other associates to process information and create presentations and reports based on recommendations and findings.

Education: A bachelor's degree in computer science, statistics, or information systems can give you the foundational technical skills you need as a data analyst. As data collection, management, and analysis become more complex and technology advances, many employers are in search of candidates with master's degrees.

Salary: The average Data Analyst salary in Kansas is $79,563 as of July 25, 2023, but the salary range typically falls between $71,212 and $89,016.

Links:
https://graduate.northeastern.edu/resources/what-does-a-data-analyst-do/
https://www.salary.com/research/salary/listing/data-analyst-salary/ks

Food Scientist:

Description: Food scientists work to discover or develop new foods and food manufacturing methods and to monitor existing food processing. Many food scientists work for private companies; others work for government agencies concerned with food safety and nutrition, or for colleges and universities. Food science careers in the 21st century are becoming increasingly hi-tech, with the growing use of biotechnology and nanotechnology.
A food scientist works in a field in which they may be responsible for analyzing and improving the nutritional value of the foods people eat. Food scientists also work to develop entirely new foods and improve existing food

production methods. Some food scientists monitor food processing, preservation, and storage to ensure that foods are manufactured and packaged using methods that are safe and sanitary.

Education: A bachelor's degree in agricultural science with a concentration in food science is the most common route for those interested in becoming a food scientist. Earning this degree typically takes four years. Basic courses include biology, botany, chemistry, and principles of statistical analysis. Specialized courses teach about food processing, nutritional analysis, and food safety.

Salary: The average Food Scientist salary in Kansas is $61,340, but the salary range typically falls between $54,790 and $69,180.

Links:
https://www.bls.gov/ooh/life-physical-and-social-science/agricultural-and-food-scientists.htm#:~:text=Food%20scientists%20and%20technologists%20use,processed%20foods%20safe%20and%20healthy.

https://www.ziprecruiter.com/Salaries/R-D-Food-Scientist-Salary--in-Kansas

Nutritionist:

Description: A nutritionist is a professional who works with clients to give individualized food and nutrition guidelines that help the client work towards a healthier lifestyle. Nutritionists tend to use a holistic approach and consider factors like biochemistry, environment, mental health, and more to help patients. These professionals must complete formal education and training before earning state licensure to practice. Nutritionists typically work full-time and may need to keep irregular hours to work with their patients. Nutritionists work with their clients to help them reach a variety of goals, such as weight loss, healthier eating habits, and managing stress. This may involve equipping patients with tools for behavior modification and adjusting their dietary approach. Nutritionists may work in a clinical or community setting but in general, these professionals may be responsible for duties such as: evaluating clients' health needs, discussing nutrition and eating habits with clients, developing educational resources for clients, determining the best nutrition plan for each client, adjusting plans as needed, monitoring clients' progress, staying updated on the latest research in the field, and helping clients manage disease (such as diabetes) through nutrition.

Education: While students can pursue an associate's degree in nutrition up to a Ph.D. in Nutrition, most nutritionists only need a bachelor's degree. Some bachelor's degree programs, such as a bachelor's degree in holistic nutrition, are available in online formats, but many of these degree programs are on-campus due to the hands-on nature of the field. Students can most commonly pursue a Bachelor of Science (BS) in Nutrition. These programs may offer tracks to become registered dieticians or tracks that lead to other nutrition-related careers in research, community

work, and more. These degree programs usually include an internship and/or other hands-on experiences working with clients.

Salary: The average Dietitian salary in Kansas is $65,274 as of July 25, 2023, but the range typically falls between $59,419 and $71,729.

Links:
https://www.bls.gov/ooh/healthcare/dietitians-and-nutritionists.htm#:~:text=Dietitians%20and%20nutritionists%20counsel%20clients,help%20people%20lead%20healthy%20lives.

https://www.salary.com/research/salary/benchmark/dietitian-salary/ks

Take a look at the Career Glossary to find other related careers!

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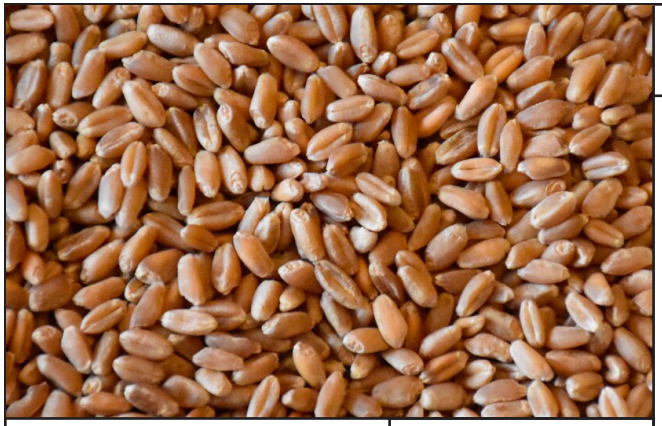

Hard Red Winter

Hardness: Hard

Shape: Bullet shaped

Color: Reddish-brown

Out of all six classes of wheat, the US produces the most Hard Red Winter wheat. It is grown in the Great Plains states, extending from the Mississippi River west to the Rocky Mountains and from Canada to Mexico. Hard Red Winter wheat has a wide range of protein content and is used to produce bread, rolls, Asian noodles, flat bread, all-purpose flour, and cereal. The US exports Hard Red Winter wheat to Russia, China, Japan, Morocco, and Poland.

Hard Red Spring

Hard Red Spring wheat contains the highest percentage of protein and strong gluten characteristics. This makes it a good wheat for making bread, rolls, croissants, bagels, and pizza crust. It is also used as a blending wheat to increase protein in lower protein flour. It is planted in the northern areas of the US where the summers are mild. Hard Red Spring wheat is exported to Central America, Japan, Philippines, and Russia.

Hardness: Hard

Shape: Bullet shaped

Color: Reddish-brown

Soft Red Winter

Soft Red Winter wheat has a relatively low percentage of protein compared to the hard red varieties of wheat. Because it is a softer variety of wheat, it grinds more easily than the hard wheats. It is used to make flat breads, cakes, cookies, pretzels, pastries, and crackers. This wheat is primarily grown east of the Mississippi River. The US exports Soft Red Winter wheat to China, Egypt, and Morocco.

Hardness: Soft

Shape: Barrel shaped

Color: Tan

Soft White

Soft White wheat has a low protein and moisture content. It is used to make cakes, crackers, cookies, pastries, quick breads, muffins, Asian noodles, Middle Eastern flat breads, and snack foods. This wheat is grown mainly in the Pacific Northwest, but is also grown in California, Michigan, Wisconsin, and New York. Soft White wheat is exported mostly to the Far East Asian region.

Hardness: Soft

Shape: Short and plump

Color: Light tan

Hard White

Hard White wheat is the newest class of wheat to be grown in the US. This wheat is similar to Hard Red wheat except for its color and milder, sweeter flavor. Its protein characteristics are identical to Hard Red wheat. Most Hard White wheat is grown in Kansas and Colorado. This wheat is used to make bread, hard rolls, bulgur, tortillas, flat bread, and Asian noodles. It is primarily used in US markets and only exported in limited quantities.

Hardness: Hard

Shape: Bullet shaped

Color: Light tan

Durum

Durum wheat is a botanically separate species from from the hard and soft wheat varieties. It is the hardest of all wheats. Durum has a high protein and gluten content and is ideal for milling into semolina flour to make pasta. It is also used to produce couscous and some Mediterranean breads. North Dakota is the largest US producer of Durum wheat. It is also grown in the same northern states as Hard Red Spring wheat. Durum is only exported in limited quantities.

Hardness: Hard

Shape: Long

Color: Amber

Grocery Shopping List

In the table below, record what product you chose at each station to purchase. Make sure to include why you chose that product in the notes section.

Product	**Notes**	

EWG's 2022

Shopper's Guide to Pesticides in Produce

CUT ALONG LINE

Instructions:

1. Cut along the outside line.
2. Fold along the middle line.

For more information visit **ewg.org/foodnews**

Crop Notes Chart

Name Date Class

Directions: At each station record the following information for each type of wheat. Write any questions you think of in the box on page 2.

Type of wheat	Where it is grown	Nutritional Contents	Products it is used in	Where it is exported

Type of wheat	Where it is grown	Nutritional Contents	Products it is used in	Where it is exported

Questions I have	Additional information

Reflect: If you were a **crop consultant** and you needed to choose the type of wheat you wanted to grow, which variety would you choose and why?