

# *Problem-Based Mathematics: You Reap What You Sow*

## Farming Factors



NOTES

**Logistics:** In this lesson, students will use their understanding of Earth Science and environmental factors to evaluate the variables that influence crop growth. Using prior knowledge and referencing personal experiences, students will categorize these variables and evaluate the significance and of each and determine whether or not the variable can be controlled. Finally, students will be introduced to the concept of three-field rotation systems in the book, *Till Year's Good End*. Students will make connections between this rotation system and farming variables that were previously identified.

### **Materials:**

*per student:*

5-10 – small sticky notes

*per group of two or three students:*

1 – piece of white 11"x17" copy paper

*for the teacher:*

1 – copy of the book *Till Year's Good End* by W.Nikola-Lisa

**Time:** One 60-minute class period

### **Objectives:**

- Determine multiple variables that influence farming and crop yield, and predict a system that may assist in the maintenance of these variables. **MS-LS1-5, SEP1, SEP6, SEP8**
- Determine the meaning and significance of vocabulary specific to three-field rotation systems (i.e., field rotation system, fallow field, plow, etc.) as they are used in a text, and evaluate how these ideas are related to the scientific aspects of agriculture. **RI.6.7, RI.7.2**
- Gain a historical perspective of the significance of agriculture and farming in the Medieval period. **RH.6-8.4, RH.6-8.7**

**Introduction:** Begin this inquiry by informing students they will be investigating one of the most important aspects of medieval times-farming. Tending to crops and maintaining fields not only produced food and nourishment for the farmers and their families, but also provided a surplus that could be used for trade and rent.

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## NOTES

Allow students time to work their way through each activity. In **Part I**, students will use prior knowledge to brainstorm a list of variables that influence crop production. This will lead to a whole-class discussion in which students predict and propose a system that may maintain or control these variables. Identifying the need to eliminate pests and maintain soil nutrients, students may begin to understand the need of a field rotation system.

In **Part II**, students will read *Till Year's Good End* by W. Nikola-Lisa and discuss how the three-field rotation system provided for medieval farmers. They will also investigate how this rotation system addressed various farming factors that were identified earlier. Students will evaluate the versatility and value of crop yields while developing a foundational understanding of how important farming was for many medieval families.

### Activity:

#### Part 1 (30 minutes):

Arrange students into groups of 2 or 3. Pass out the 11"x17" pieces of copy papers and approximately 30 small sticky notes to each group. Inform students that they will be given a scenario similar to a situation that a farmer in medieval times would experience.



Read the following scenario to the students:

*"It is March in the year 480, and you are ready to prepare your field for farming. As a peasant, you have made an arrangement with the lord of the manor and hope to produce enough crops to feed your family, repay the lord, and have a surplus take to the market to sell. It is the beginning of the harvesting season, and so much work is ahead of you. Before preparing the field, your farming team meets to discuss all of the factors that will play a role in crop production. As a farmer, what factors impact the growth of your crops?"*

Begin student inquiry by asking the students to write down any factors related to crop production that the farmer should consider. Students should write one idea per sticky note, and place the sticky note on the 11x17 paper. While they are working, students may ask for guidance or feedback. While it is okay to acknowledge their ideas, refer them back to

the passage and encourage them to write down *all* ideas that would contribute to crop production.

After several minutes of individual brainstorming, have the students discuss the ideas that were written on the sticky notes. Then, tell each group to organize their sticky notes into categories. It is important for students to make and label their own categories on the 11"x17" paper.



Once all groups have finished organizing their factors, have each group share one or two of their categories. You could also have students display their 11"x17" pieces of paper around the room. During this time, encourage students to add to each category.

If students need more information regarding the following variables, you may wish to elaborate on the following:

**Pests:** Improperly maintaining crops contributes to pest infestations. This often happens when crops of the same family are planted in consecutive seasons. For example, pests often invade crops that were grown in the same field, year after year. Pests may also impact production if too much of one crop is grown in a single field.

**Weather:** Climate heavily influences the farming season. Weather factors such as drought and frost will negatively impact crop growth, while humidity and appropriate levels of sun light will increase production. Students may be aware of the time of year when seasonal crops are planted and harvested at local farms. During the Medieval period, European farmers could farm year round because of the mild climate.

**Soil Nutrients:** Crop production heavily depends on soil nutrients. Different types of crops use different types and amounts of nutrients. Therefore, in order to avoid completely depleting soil nutrients, certain crops cannot be planted season after season. Soil nutrients include pH, nitrogen, phosphorus, and potassium.

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## Debrief Part I:



The purpose of this debrief is for students to understand that multiple variables influence farming and crop yield, and that although some have a more significant impact on production than others, select variables can be regulated. As students develop this understanding, they will then be encouraged to brainstorm a system that may assist in the management of these variables. Ask students the following questions:

- ✓ **Which factors do you think have the most significant impact on crop growth?**
- ✓ **Which factors do you think have the least impact on crop growth?**
- ✓ **Is there another term that we can use to describe these factors?**
- ✓ **Which variables can a farmer control? Which variables are unmanageable?**

Next, students will brainstorm, or predict, a system that may assist in the maintenance of the identified variables. Encourage the students to discuss and plan these systems as a group. You may wish to provide them with paper to record their designs. Depending on personal experience and knowledge of the agricultural industry, some students may or may not be familiar with the concept of a field rotation system. Pose the following question to students:

- ✓ **What system could a farmer use to limit pest infestations and maintain appropriate levels of soil nutrients?**

When all students have completed their work, allow volunteers to share their systems. During this time, encourage students to elaborate on how they believe their system will help control the manageable variables.

## Part 2 (20-30 minutes):

Read aloud the story *Till Year's Good End* by W. Nikola-Lisa. The book is segmented into months and written to depict a medieval farmer's calendar. This is a great opportunity to include a community member or outside presenter to read to the students. The book will take approximately 15 minutes to read.



This book not only provides students with a perspective of how important farming was to medieval society, but also introduces the concept of the three-field rotation system. While you are reading through the book, you may want to stop at the following pages and further discuss these items:

- **January** – how land was arranged and the concept of using crop yields as “rent”. Students may also discuss how else crop yields were used (i.e., consumption, maintenance, replanting, market goods)
- **March** – the use of oxen and plows as farming technology, the introduction of the three-field rotation system, and sowing of grains.
- **July** – how grains were bundled and the sowing of leeks, onions, peas, and beans.
- **October** – the grinding of grains into flour to make bread and the plowing and sowing of the winter fields.

At the conclusion of the book, students may be interested in understanding what the three-field rotation system entails. To encourage student discovery, avoid displaying a visual of the system or providing them with additional insight into the logistics of rotating crops amongst various fields. This idea will be addressed in the following activity, *Three-Crop Rotation System*.

## Debrief Part 2:



After reading the book, discuss the following questions as a class:

- ✓ **Why was farming such an important industry for medieval families?**
- ✓ **What were a few of the farming technologies that were used in the fields?**
- ✓ **What is a fallow field?**
- ✓ **What was the role of sheep and cattle in the fallow fields?**
- ✓ **How do you think a three-field rotation system works?**

During debrief, you may wish to record the students’ initial ideas of a three-field rotation system on the whiteboard or chart paper to revisit at the end of the activity.

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## NOTES

### EXTENSION:

You may choose to allow students extra time to investigate the nitrogen cycle and its relation to the field rotation system. This concept was unknown to medieval farmers, so their understanding of field rotation was based solely on observation and experience. However, this is a concept that modern day farmers and agriculturists study. This cycle explains how plants obtain, produce, and use nitrogen. There are a variety of resources and interactive websites that are available for students to investigate:



<http://studyjams.scholastic.com/studyjams/jams/science/ecosystems/nitrogen-cycle.htm>

[http://www.classzone.com/books/ml\\_science\\_share/vis\\_sim/em05\\_pg20\\_nitrogen/em05\\_pg20\\_nitrogen.swf](http://www.classzone.com/books/ml_science_share/vis_sim/em05_pg20_nitrogen/em05_pg20_nitrogen.swf)

<https://www.youtube.com/watch?v=QgcvFhMw4dk>

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