Grade Level: 4

Title: What's With the Plants?

Purpose:
The purpose of this lesson is for students to solve a real world problem using information from more than one resource.

Subject Area(s) Addressed:
Social Studies, Math, ELA

Common Core/Essential Standards:
Social Studies
4.E.1.2 Understand how scarcity and choice in a market economy impacts business decisions.

Math
"Mathematically proficient fourth grade students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fourth graders should evaluate their results in the context of the situation and reflect on whether the results make sense."
(Source: Common Core - Standards for Mathematical Practices)

4.NBT.3 Use place value understanding to round multi-digit whole numbers to any place.

4.NBT.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

4.NBT.6 Find whole-number quotients and remainders with up to four-digit dividends and one- digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

ELA
4.RIT.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

4.SL.9. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Vocabulary:
comparison
cost
profit
variety
yield

Materials Needed:
math journals
internet access
chart paper
stickers or markers
calculators
Strawberry Plant Spacing chart (see last pages of this lesson)

Teaching Strategy:

Part 1: Deciding how many plants to purchase
Why do businessmen go into business? Primarily to make money, though they may have other goals as well. What about farmers? Farmers are in business to make a profit. Therefore, when they order plants, they want to make sure they order enough to fill their fields and have a few extra in case they need to replant. They don't want to over-purchase and waste money by having an excess number of plants. Explain to students that they are going to be "farmers" deciding how many plants they need to purchase for a section of "land" that is 100 feet long. Take students outside or to the gym and have them mark off with string or rope an area 100 feet in length. As the teacher, you may choose which strawberry spacing to have students use for the activity.
Ask students to make predictions about how many plants they think they will need for a single 100 foot row. Create a class line plot to record student predictions.

Next, using the table "Strawberry Plant Spacing" included with this lesson compare student predictions to the recommended quantities. Then, determine the number of plants in 5 rows and 10 rows for each strawberry entry. Based on students' achievement level, have students determine the number of strawberry plants needed for 1 - 5 acres. Record the information in their math journals.

Part 2: Deciding which plants to purchase
Explain to students that there are many types or varieties of strawberries (just like there are many   different types of sodas). Different varieties grow better in some places as opposed to others and have different qualities that farmers may want. Have students brainstorm reasons strawberry farmers should consider

purchasing one variety over another. Record the students' ideas on a class chart. Some reasons should include the type of soil in the area, the climate, and the yield (number/pounds of berries per plant). Farmers' reasons also include factors such as time of harvest (early/late), disease resistance, how long they keep after harvest, and flavor.

Next, have students work in groups of 2 or 3 to research the following varieties grown in North Carolina:

Camarosa, Chandler, Sweet Charlie -- commonly planted in NC
Albion, Seascape, Strawberry Festival – less commonly planted
Benecia, Monterey, Flavorfest -- new varieties being tried

Have each group create a PowerPoint slide or other digital means of sharing their research information with the class. As a class, diplomatically choose 3 different varieties that would grow well in your area for Part 3 of the lesson. When deciding, students should refer to the brainstorming chart when defending their choice.

Part 3: Making the purchase
Students will now research the cost of each variety of strawberry they chose and determine the estimated cost of 1000 strawberry plants. They should look at more than one website to compare prices. Emphasize that when making a major purchase, farmers comparison shop to find the best price on equipment as well as plants.

Next, determine the cost of strawberry plants for 1-5 acres of land. (Teacher will determine the number of acres based on Part 1. Students will need to use a calculator. Have students record the information in their math journals.

Extension Activities:

Extension 1: Have students research propagation of strawberry plants and compare this practice to planting seeds. Discuss the advantages and disadvantages of each. (Strawberries are always vegetatively propagated and sold as plants, except for a few non-commercial types, like Alpine strawberries.)

Extension 2: Have students research genetically modified plants compared to non-genetically modified plants. Discuss the advantages and disadvantages of each. How does each impact cost and profit? GMO's are a hot topic of discussion among environmentalists, farmers, and consumer advocates. Why is there so much hype about GMO's? (Note that NO strawberries sold or grown are genetically modified.)

Extension 3: Have students research "What's an acre?" This measure of area has no exact dimensions. Have them figure an acre of area of different dimensions (square, various rectangles) and how many rows of strawberry beds they could put in each acre, and what the total length of all the rows is. Do they think it would be better for a farmer to run rows the long way or the short way on a long, skinny rectangle? What would be important factors?

Background Information:

For Part 1:

Strawberries in North Carolina are usually grown in double rows on black plastic-covered raised beds set 5 feet apart. 12" and 15" spacings are most commonly used in NC strawberry plasticulture. "Rule of thumb" quantities, respectively, are 17,500 and 15,000 plants/acre. If plants are grown in the same field, year after year, the farmer develops a good idea of how many are needed. In recent years, farmers have been moving away from the closer spacings to wider spacing, to save on the cost of plants, and reduce disease in the fields – with more open spacing, there is more air circulaton. Strawberry growers always get some extras in case some of the transplants die.

Varieties that tend to stay small may be planted more closely together than those that grow into large plants.

Plants/acre will vary based on field shape and other considerations. The plasticulture acreages in the table below were calculated using a square acre 206 x 206.

For Part 2:

To research strawberry varieties, students may use the following websites. The information on these sites includes varieties recommended for NC as well as other states.

http://www.ncstrawberry.com/docs/ProductionMethods.htm
http://strawberryplants.org/2010/10/strawberry-varieties-by-state/
http://strawberryplants.org/2010/05/strawberry-varieties/

For Part 3:

Use the link below to contact plant suppliers for prices on strawberry plants; some of the suppliers list prices on their websites. Teachers may choose to contact the suppliers and compile a list for students depending on Internet and email access. Otherwise students may work in groups to compile pricing information.

http://www.ncstrawberry.com/docs/2013PlantSupplierList.pdf

For Extension 3:

An **acre** is a measure of area, not length, and is defined in square feet. An acre can be of any shape—a rectangle, a triangle, a circle, or even a star—so long as its area is exactly 43,560 square feet. The most standard shape for an acre is one furlong by one chain, or 660 feet by 66 feet. To find the linear measurements of other rectangular acres, just divide 43,560 by the number of feet you want on one side. A square-shaped acre would then be about 208.7 by 208.7 feet (because 208.7 x 208.7 = ~43,560). An acre 100 feet wide would be 435.6 feet long (100 x 435.6 = 43,560) and an acre 1 foot wide would be 43,560 feet long. The acre was originally an English unit of measurement that described the area that a **yoke** of oxen could plow in a day. It originally differed in size from one area to the next,

but was ultimately fixed at 4,840 square yards, or 160 square chains (its current size).

Assessment:
Part 1:
Math journal entries
Participation in discussion

Part 2:
PowerPoint slide
Oral Presentation to class

Part 3:
Math journal entries

Strawberry Plant Spacing

Row spacing (feet)	Plant spacing (inches)	Plants/100 ft.	Plants/acre*
Matted row (perennial) strawberry production – single rows			
4'	18"	67	7,200
4'	20"	60	6,500
4'	22"	55	5,900
4'	24"	50	5,400
5'	20"	60	5,200
5'	24"	50	4,300
Plasticulture strawberry production - double rows			
5'	8"	300	25,584
5'	12"	200	17,056
5'	15"	160	13,650

Plants/acre will vary based on field shape and other considerations. The plasticulture acreages in the table were calculated based on a square acre 206 x 206.

The picture on the left shows plasticulture plant spacing in a home/school garden setting. The one on the right shows recently set plants on a North Carolina farm. Note that plants are usually set in a staggered double row on the bed. Beds are on "5 ft. centers", meaning that the center of each bed is 5 ft. from the center of the next. Most NC farmers currently plant about 15,000 plants per acre.
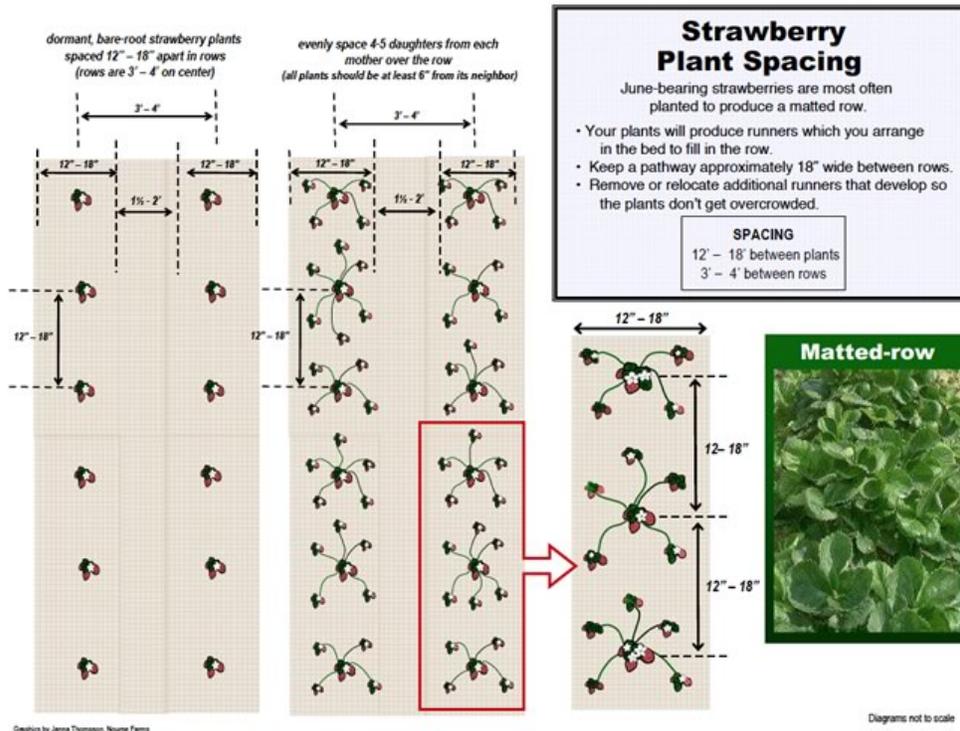
This chart shows spacing for matted row plants, which stay in the ground for several years, so they spread and multiply. For this reason, they are set out further apart than in plasticulture.