Grade Level: 5

Title: Producing Plants (Sept. - Oct.)

Purpose:

The purpose of this lesson is for students to develop an understanding of plant production.

Subject Area(s) Addressed:

Science, Social Studies

Common Core/Essential Standards:

Science:

5.L.3.2 Give examples of likenesses that are inherited and some that are not.

Social Studies:

5.G.1.3 Exemplify how technological advances (communication, transportation and agriculture) have allowed people to overcome geographic limitations.

Vocabulary:

genetically modified organism
hybridization
propagation

Materials Needed:

apples, other fruits and vegetables, garden seeds
strawberries, strawberry plant (preferably with runners) or picture
journals
internet access

Teaching Strategy:

Part 1:

Start with a discussion of seeds. Bring in some vegetables, eg. carrot, pepper, lettuce, green beans and the garden seeds that are used to grow them, and have students examine them. Ask them to find seeds in nature, on the school grounds, etc. (acorns, weed seeds, etc.), try to figure out what they are from, and bring them in with a piece of the plant. Examine them together. You may note that there are lots of similarities among different kinds of bean seeds, acorns, etc.

Give each student an apple – or hold up an apple. Ask students where we get apples. (a tree). How do apple trees get started? Most will respond with planting seeds. Ask students where the seeds come from. Most should say from the inside of the fruit; cut open an apple and separate out the seeds. Most school cafeterias serve apples so this should help students make connections. As a

class, research how apple trees are started (not from seed but from plant propagation; apple orchards buy young trees).

Ask students how strawberry plants are started. Using real strawberries (preferred) or a picture of a strawberry, ask students to locate the strawberry seeds (on the outside of the berry). Ask students to discuss whether or not they could plant those seeds. Most will say yes. Explain to students that it is possible to plant strawberry seeds. Then, ask students if they think this is the way strawberries typically are started. Students whose families grow gardens may know that some people use seedlings or sprouts in their gardens. Ask students if they have ever been to a shop that sells plants (ex. Lowe's, Wal-Mart, hardware store, feed store). Explain how people often buy plants that are already growing and transplant them to their own garden. This is another popular way to plant fruits and vegetables in the garden. Have students predict which would take longer to produce fruit, the seed or the seeding and record their thoughts in their journals.

Part 2:
(Transition) Now that students have seen the strawberry seed from either a real strawberry or a picture, show them a strawberry plant with runners. (If you have access, an actual plant is better than a picture.) Identify the mother and daughter plants. The mother plant is the main plant and the daughter plants are the ones that form along the runner. Discuss the similarities and differences in the mother and daughter plants. Inform students that the mother and daughter plants play an important role in producing new strawberry plants. Put the word *propagation* on the board. Ask students if they know what it means. Most will say no. Show the following video www.youtube.com/watch?v=cQztgR6Nqqc**.** This video explains and demonstrates the process of propagation for a small garden. The narrator explains what he is doing and why. Students should easily understand the concept following the video. At the end of the video, have students write and share their own definition of plant propagation.

Part 3:
Ask students which method they think would be better for a farmer, planting from seeds or planting from seedlings that were propagated. Have them discuss possible problems a farmer might encounter when planting seeds. (i.e. they do not germinate, birds eat them, rain waters wash them away, etc.). Next, ask students if they think strawberry farmers propagate their own strawberry plants. Have students research propagation of strawberry plants and compare this practice to planting seeds. In a chart, record, then discuss, the advantages and disadvantages of each on a commercial scale.

Part 4:
Tell students there are many varieties or types of strawberry plants with new varieties being created all the time. Ask students, "How are new strawberry varieties created?" Introduce the idea of *hybridization.* (See Background Information for points to cover.) Have students research varieties of strawberries

to learn how they were developed. What varieties were crossbred to create new ones?

North Carolina State University has its own strawberry breeder, based in Kannapolis. See http://plantsforhumanhealth.ncsu.edu/people/jeremy-pattison/ which includes a good video about this.

*If possible, find a local strawberry plant producer and invite him/her to visit your classroom to explain more about propagation and hybridization. If there is no one local, teachers may be able to use Skype to arrange an interview with students.

Extension Activities:

Experiment: Have students plant some broccoli seed and a broccoli transplant on the same day and grow them over time. Have students predict what they think the results will be. This will be a concept that takes several months to know the final results. Share with students that researchers frequently deal with long-term results.
If you are on a traditional calendar and have a school garden, the broccoli can be planted in late summer or as early as February 15. If you do not have a school garden, plant in large pots. (Information on planting is available at your local cooperative extension office or online (see http://cals.ncsu.edu/hort_sci/extension/HorticulturePublicationsVegetables.php**).** If you are not familiar with gardening, the cooperative extension horticulture agent will be a great resource person for you to contact.)

Have students investigate sprouting seeds in a greenhouse. The experiment from Part 1 using the plastic wrap over the container is similar to what happens in a greenhouse. Following is a video that shows how a company in Japan produces fruits in a greenhouse beginning in December.
www.youtube.com/watch?v=aae033cbduw
Video on high tunnel strawberry research in NC
www.youtube.com/watch?v=2vy3EuJYkOs
Greenhouse production in FL www.youtube.com/watch?v=lUlr79R6eGQ

Background Information:

Strawberries are almost NEVER (except perhaps for alpine types) grown from seed. Like most fruit crops, they are vegetatively propagated, from a plant part and not seed. One important reason is that this ensures that the offspring will be “true-to-type”, basically clones of the parent plants. Strawberries make this easier than some because they naturally propagate prolifically through their runners and daughter plants.

Farmers and gardeners have been raising strawberries from the runners ever since strawberries were domesticated. Strawberry plants are raised by strawberry nurseries, which grow the plants for these daughter plants rather than for their fruit (though they may also harvest some fruit). They may sell the tips

(the daughter plants before they set roots) to other nurseries or to fruit farmers who then grow them into plug plants, or they may let the daughter plants root, then dig them up, remove the soil from the roots, and then sell them as “bare root plants.”

The other benefit for setting out strawberry plants is the same as for other crops for which transplants are used instead of seed – seeds can be hard to grow, but farmers can set out just a few plants, space them exactly where they want them and be much more assured that they will survive and “get a good stand.”

Strawberry plant breeders do raise plants from seeds because they are actively seeking new and unexpected crosses—the genetics of a seed are unpredictable combinations of the genetics of the parents. Plant breeders manage these crosses, picking specific parent plants to cross, because they are looking to get characteristics of each parent into the offspring—for example, one parent may be very productive, but not have very good tasting fruit while the other may have good fruit but not be very productive. They hope the offspring will have the good characteristics of both: very productive and with good fruit. Of course, they could also get offspring that are unproductive and have poor fruit.

Hybridization is defined at http://dictionary.kids.net.au/word/hybridization, as “the act of mixing different species or varieties of animals or plants and thus to produce hybrids."

The most common type of hybridization involves crossing two organisms of different breeds (in cultivated plants, these are called varieties or cultivars) *within the same species*. This is also called crossbreeding. In agriculture, it is used to create healthier crops, varieties that combine good features of the two parents or new flavors. An example of *cross-species* hybridization is the **tangelo**, a cross between a **tangerine** and a **pomelo**. In agriculture, it is vitally important to maintain genetic diversity, and by extension the health and longevity of a crop. Many large agricultural companies engage in monocropping, planting only one strain of one crop, which is very harmful for diversity and for the plant. Should the crop be susceptible to a particular fungus or insect, the whole field will be lost. Hybridized crops, on the other hand, tend to be more resistant to disease and infestation (www.wisegeek.org/what-is-hybridization.htm)**.** Hybridization is not to be confused with genetically modified organisms (GMO's) which means a foreign agent or genetics of a totally different type of organism, like genes from a bacterium into a plant) has been introduced to the original organism to produce desired results (www.wishfarms.com/genetically-modified-organisms-gmos-explained/)

The cultivated strawberry *Fragaria x ananassa* is an accidental hybrid between *F. chiloensis,* which grows along the western seaboard of North and South America as far south as Chile, and *F. virginiana* which is a woodland species mostly found in eastern North America. Both were eaten by indigenous peoples there before they were brought to Europe in the mid-16th century, where they were cultivated

separately. Their fruits were larger than native European species which made them desirable, but the key event in modern strawberry history was a chance cross-pollination between these two species when they were grown together in France. The offspring was the even larger fruited *F. x ananassa. (*From http://digitalbotanicgarden.blogspot.com/2009/12/cultivated-strawberry-fragaria-x.html. For more on this botanic history, also see http://en.wikipedia.org/wiki/Strawberry**)**

Additional Resources;

School strawberry gardens:
http://cals.ncsu.edu/hort_sci/extension/documents/TeachFromTheGardenStrawberries.pdf
Growing strawberries in containers or home gardens:
http://petitefarmstead.com/2011/06/how-to-grow-strawberries-in-containers/
http://gardening.about.com/od/berries/qt/How-To-Grow-Strawberry-Plants-In-Pots.htm
www.wikihow.com/Grow-Strawberries
http://bonnieplants.com/strawberries/ (Includes a video and is kid friendly)

Strawberry varieties grown in our region:
www.ncstrawberry.com/docs/ProductionMethods.htm
www.gandwnurseries.com/plants_offered_1.html

Good regional info at
www.clemson.edu/extension/hgic/plants/vegetables/small_fruits/hgic1405.html

Students can also use a search engine to research the specific types of strawberries.

Assessment:

Part 1: Observations / comparisons

Part 2: Definition

Part 3: Chart and participation in class discussion

Part 4: Research findings

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