

**Grade Level: 5**

**Title: Water and the Weather (Oct. - Apr.)**

**Purpose:**

The purpose of this lesson is for students to develop an understanding of weather patterns.

**Subject Area(s) Addressed:**

Science, Math

**Common Core/Essential Standards:**

**Science**

5.E.1.1 Compare daily and seasonal changes in weather conditions and patterns.

**Math**

5.NBT.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

5.MD.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

**Vocabulary:**

drought  
flooding  
irrigation

precipitation  
temperature  
weather

wind direction  
wind speed

**Materials Provided:**

“Weather Journal”  
“Video Response Sheet”

**Materials Needed:**

weather station or TV access  
Internet access

**Teaching Strategy:**

This lesson will easily integrate with any weather unit. The weather journal included can be used to record data year round. It also includes columns for both standard and metric measures which will easily integrate into the math curriculum. This lesson is designed to complement any existing unit on weather and/or measurement.

**Part 1:**

Farmers carefully watch the weather in order to know when they need to irrigate. Each day they record the weather conditions in order to give proper care to their strawberries. Students will keep a journal recording the daily high and low temperatures, amount of precipitation, and their observations using both standard and metric measures. \*If the school has a strawberry garden, students should also record plant growth for the entire year. Schools with the "1:1" technology program should use their digital devices to create a product (spreadsheet or table). Next, have students research the amount of water needed per week for the strawberries. Have students calculate the amount of rainfall for the week and determine whether or not strawberries should be irrigated during that time. Record all data in their journal.

**Part 2:**

Strawberries need little care during the winter months. However, there are measures that need to be taken when the temperature drops to a certain point. Give students copies of "Video Response Sheet." Students will watch the video found at <http://strawberries.ces.ncsu.edu/2009/12/mauris-sed-leo-aliquam-aliquam/> and listen for the answers to the questions on the hand-out. Review responses for accuracy of information.

Ask students to determine the difference between a freeze and a frost. The following website provides an adequate distinction between the two: <http://www.gov.mb.ca/agriculture/crops/fruit/blb01s21.html#The Frost Control Principle and Frost Injury Levels> (Note that the production system used in this area differs from that used in North Carolina). The teacher may choose to have students do a more in-depth study on the differences based on student interests or learning needs.

Next, have students research how cold, frost, snow and ice (caused by freezing rain) affect strawberry plants at different stages of growth. Since freezing temperatures and frost are key issues for strawberry growers, have students focus their research to frost and freeze protection methods, specifically the use of row covers or water sprinklers. The website listed above and the following websites provide information on protection methods, temperatures, and general weather information: <http://pubs.ext.vt.edu/2906/2906-1386/2906-1386.html>. Students may also interact with the "We Grow Strawberries" blog at <http://wegrowstrawberries.blogspot.com/>. Have students create a digital product to share the information they learned from their research.

**Part 3:**

How does excess rain affect the strawberry farm? Students have learned about irrigation at this point. Have students discuss what may happen if there is too much rain or flooding. Strawberry farmers use a lot of water when they set out plants, but an excess amount of water can cause problems for the strawberry

farms, especially when they are getting the soil ready, as fruit are developing, or at harvest time. Have students research the effects of too much water. They should look at plant rot and diseases. Students should create a multi-flow map (<http://www.eisd.net/domain/599>) showing cause and effect of excess rain.

## **Background Information:**

### **NC Strawberries:**

General information on Strawberries in NC provided by the NC Cooperative Extension: <http://strawberries.ces.ncsu.edu/>

### **Frost Protection of Strawberries**

Detailed information for strawberry growers on Frost Protection:

<http://www.ncstrawberry.com/docs/IrrigationforStrawberryFrostProtection.pdf>

The measures that strawberry growers take to protect their plants are determined by several factors besides temperature. These include:

- Stage of growth of the plants. Flowers are more susceptible than other parts of the plant)
- Number of flowers on the plant (percentage of crop at economic risk)
- Time of year (even if a plant is flowering in January, there is no point protecting those flowers, as they are likely few in number and will also ripen before any buyers are ready for them.) Also, if farmers invest time and energy in protecting such extra-early berries, there is a good chance that a hard freeze will come later and overwhelm these early efforts.
- Farm capability – Does the farm have row covers? Is enough labor available? Is enough water available? In a drought year, growers may forgo early frost protection so they can be sure to have enough water in their ponds for critical later freezes.
- Economics – Does the potential loss justify the labor expense?

Bloom and flower parts are most susceptible to freezing temperatures. Dormant plants (December-February) are only protected if temperatures drop below 15° F, as these temperatures can damage the crowns of the plants, especially if plants are not yet accustomed to cold. Row covers are used for this, and not all growers protect at this stage. Snowfall and freezing rain are not a problem for strawberry plants (after all, frost protection with irrigation creates ice), and snow provides a protective blanket. These precipitation events usually do not occur at the times of critical temperatures and growth stage.

**Critical temperatures of strawberries based on stage of development  
(Perry and Poling, 1985)**

<b>Stage of Development</b>	<b>Approximate Critical Temp. (°C)</b>
Dormant plants	-10 (15 F)
Tight bud	-5.5 (22 F)
"Popcorn" (closed but visible flower)	-2.2 (26 F)
Open blossom	-1.1 (30 F)
Fruit	-2.2 (28 F)

These temperatures are plant tissue temperatures, and a degree or two lower than the critical air temperature in the plant canopy. There are many variables that affect the actual critical temperature for a given plant and the amount of injury.

- Duration of cold
- Growing conditions prior to the cold event
- Cultivars: (because of plant habit, or avoidance, rather than genetic differences)
- Stage of development
- Super cooling (in the absence of ice nucleation points, plant sap can cool below the freezing point without forming ice crystals)
- Soil type and condition (moist dark soil holds more heat than dry light soil)

(from [www.ncstrawberry.com/docs/IrrigationforStrawberryFrostProtection.pdf](http://www.ncstrawberry.com/docs/IrrigationforStrawberryFrostProtection.pdf))

**Irrigation:**

There are many kinds of irrigation systems:

- Central pivot irrigation and large moving boom systems are used on farms with large fields, especially in the Midwest.
- Solid set overhead irrigation has pipes laid in the field, with periodic risers coming up from these pipes at intervals, and rotating sprinkler heads on these risers.
- Drip or trickle irrigation uses plastic tapes or tubes set on top of the soil or just below the soil surface. Water is piped at low pressure and drips out through emitters or small holes. This is a very efficient use of water, as it is delivered right at the root zone. Because foliage does not get wet, disease problems are reduced as well. Garden soaker hoses serve a similar purpose.
- Furrow or flood irrigation spreads water on top of the soil through ditches through the field.

- And then there is hand watering through a hose, with buckets, etc., the methods used by many home gardeners and farmers throughout the world over the centuries.

Strawberry farmers using the plasticulture system typically use overhead irrigation ONLY to help establish newly set out plants, for frost protection, and sometimes for evaporative cooling during hot weather in spring. All the rest of the time, they rely on drip irrigation. This is partly because of the efficiency of drip irrigation, and because it does not get foliage and fruit wet. But it is also because once they have committed to using black plastic mulch, they must use a method that puts the water under the black plastic, as neither rain nor overhead irrigation will put the water at the plants' root zone where it is needed.

Excellent background information on Irrigation in North Carolina by the NC Cooperative Extension: [www.ces.ncsu.edu/hil/hil-33-e.html](http://www.ces.ncsu.edu/hil/hil-33-e.html)

This article provides excellent information for developing an understanding of why farmers, especially fruit and vegetable growers, use the dripline (also called drip tape) as opposed to other irrigation methods:

<http://dripirrigation.org/images/Using%20drip%20for%20more%20than%20just%20irrigation%20COMBO.pdf>

#### **Rain on strawberries:**

Farmers need rain, but too much or too little is a problem! Strawberry farmers can generally deal with too little rain on the crop, because they irrigate, unless drought conditions are so severe that their water sources (ponds, streams, etc.) threaten to dry up. Drought is most frequently a problem when farmers are getting the soil ready to plant in the summer. Too much rain has these effects:

- It causes erosion. Because the plastic-covered raised beds used for strawberries channel rain run-off into the “middles” between the beds, fields are prone to erosion. To prevent this erosion, growers plant rye as a cover crop between the rows.
- It increases disease in the plants, especially grey mold (*Botrytis* fruit rot). This is especially a problem in spring, when plants are flowering and fruiting.
- It makes it hard to get into the field to work (e.g, to lay down the plastic or spray necessary fungicides)
- It makes fruit unmarketable. When ripe or almost ripe berries get rained on, they get soft, don't last as long, don't look as nice, and have less flavor.
- It makes harvesting difficult and unpleasant. This is a major economic issue for PYO farms, especially if it rains on the weekend. PYO farms do most of their business on the weekends, and few rainy weekends can seriously affect farm profitability.

Farmers often go through a field after a major rain and remove ripe fruit that has not been picked, either taking it out of the field or throwing it between the beds. This “field clean-up” is a major labor expense, but overripe fruit left in the field encourages more fruit rot.

**Assessment:**

**Part 1:** Weather journal

**Part 2:** Digital product

**Part 3:** Multi-flow thinking map

**Culminating:** Have students write a summary of how water affects strawberry plants.

**North Carolina Strawberry Association – [www.ncstrawberry.com](http://www.ncstrawberry.com)**

*This project was supported by the North Carolina Department of Agriculture and Consumer Services Specialty Crop Block Grant Program.*





## Video Response Sheet

1. Title of the Video \_\_\_\_\_

2. Where was the video recorded? \_\_\_\_\_

3. Who hosted the video? Include his job title. \_\_\_\_\_

4. What tool is being used in the video? \_\_\_\_\_

5. About how much does it cost? \_\_\_\_\_

6. What are two reasons strawberry farmers like this tool? \_\_\_\_\_

7. How does the farmer determine the temperature of the blossom? \_\_\_\_\_

8. Why can the wire not be exposed? \_\_\_\_\_

9. When is blossom temperature monitoring especially important? Why? \_\_\_\_\_

10. At what blossom temperature should action be taken to protect the strawberries? \_\_\_\_\_

11. Write a summary of the video. Include relevant details.

---

---

---

---

---

---

---

---

---

---