Fifth Grade Curriculum:
Wheat Farming and Climate Change in the Inland Pacific Northwest

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Real-World Scenarios: What's Happening on My Wheat Farm?

Week 3 – Day 1

Lesson Overview

The purpose of this lesson is to provide student groups an opportunity to collaboratively build understanding around a real-world agricultural scenario. Students will be analyzing both text and data to gain an initial understanding. The text and data used during this lesson will be an abbreviated version of what students will be analyzing on Day 4. The overall objective is for students to effectively collaborate with a peer group to generate background knowledge on each scenario.

Lesson Vocabulary

data, plotting, graph, and inference

Standards and Learning Targets for Lesson
Learning Targets • I can summarize both text and data to gain a deeper understanding of the scenario. • I can effectively collaborate with my group to build background knowledge on my scenario. • I can plot *x* and *y* values on a graph.
Next Generation Science Standards • 5-ESS3-1.C – Earth and Human Activity - Obtain and combine information about the ways individual communities use science ideas to protect the Earth's resources and environment.
Idaho Science Standards • 5.S.5.1.1 – Personal and Social Perspectives - Identify issues for environmental studies.
Common Core ELA Standards • RI.5.9 – Reading Informational Text - Integrate information from multiple sources on the same topic in order to write or speak about the subject knowledgeably. • SL.5.1.a/b – Speaking and Listening - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion. B. Follow agreed-upon rules for discussions and carry out assigned roles.

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Common Core Math Standards

- 5.G.2 – Geometry
  - Graph points on a coordinate plane to solve real-world and mathematical problems. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.

Materials

- Copies of the three scenarios for student groups (Assign each scenario to one or more groups and give one scenario packet to each student.)
- Graphing paper
- Rulers
- Optional: Excel graphs with and without plotted lines to scaffold graph making as needed

Lesson Duration

Approximately 2 hours

Lesson Description

During this lesson students will read the text of their respective scenarios, analyze the accompanying data, participate in collaborative discussions, plot data, and generate initial thoughts on what is happening on their wheat farms.

Engage (10 minutes)

- Lead a recap discussion on the high-quality system models crafted on the previous day.
- After the discussion, introduce the week's objectives and present the learning targets for this lesson.
- Unpack the first two learning targets: (1) *I can summarize both text and data to gain a deeper understanding of my scenario*; and (2) *I can effectively collaborate with my group to build background knowledge on my scenario*. Write the learning target on the board or on chart paper. Discuss the meaning of key words. Discuss the purpose of the lesson in terms of what students will be able to do by the end of the lesson.

Exploring the Text (30 minutes)

- Have students move into prearranged groups and receive their assigned scenario.
- Have students independently read the text, annotate the main ideas in the margins, and write down any questions or confusing statements. (15 minutes)
- After the initial reading each group will conduct the following sharing protocol:
  - Each student gets 2 minutes to present their thinking on the following points: (1) *What were some of the problems presented in the scenario?; and* (2) *What were some things you need clarification on*?

- After each student presents, give the group 1 minute to respond to the clarifying questions and the problems/solutions.

Analyzing the Data (40 minutes total)

- **Initial Observations (5 of 40 minutes)**
  - Groups will analyze the data for their scenario.
  - Each student will independently grapple with the data and make initial observations (5 minutes). This could be in the form of notice and wonder.
  - Choose a few students to share what they noticed and what they wonder about their data.

- **Mini-Lesson (15 of 40 minutes)**
  - During the mini-lesson explicitly teach how to plot ordered pairs in the first quadrant of a coordinate plane.
  - Present and unpack the last learning target: *I can plot* x *and* y *values on a graph*.

- **Mini-Lesson Expansion: Plotting and Analyzing Data (15 of 40 minutes)**
  - Have students get back into scenario groups and plot their data in a graph.
  - Monitor and assist as necessary.
  - Once students have plotted the data, ask groups to make two observations and one inference based on the graph.
  - Note: one option is to have students use the data tables to make their own graphs from scratch. Another option is to first provide students with the blank graphs so they can add the points and draw the trend line. Then provide students with the plotted graphs so they can compare their graphs to the actuals and discuss challenges and what they learned about graphing.

- **Scenario Partner Group Sharing (5 of 40 minutes)**
  - Ask different groups with the same scenario to combine.
  - Ask each group to present its plotted data, observations, and inferences.
  - After all the groups have presented, ask each group to determine one important observation and one important inference from the data.

Synthesis (20 minutes)

- Have students work independently to craft a summary of their text and data. They should answer the question: *What is happening on my wheat farm?*
- Summaries should incorporate both the textual evidence and the mathematical evidence.
- Monitor and provide assistance as needed.

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Debrief (10 minutes)

- Have the whole class circle up.
- Lead a "fist to five" debrief on the learning targets:
  - State each learning target (one at a time) and have students self-assess on meeting the learning target. They will use their hand to show zero to five fingers (fist = 0 fingers) indicates "I did not come close to meeting the learning target" and 5 fingers indicate "I fully met the learning target."
  - This self-assessment is intended as a formative assessment strategy to identify where different students may need additional support and clarification.

Scenario 1

What's Happening on My Wheat Farm in Idaho?

It is the year 2025. You are a wheat farmer in the Palouse region of the inland Pacific Northwest of the United States. For over thirty years you have been managing your family farm a few miles south of Moscow, Idaho. In 2020 you started noticing that your wheat plants don't grow as much as they did in the past. You are concerned because you are seeing more aphid damage to your wheat plants. You have also noticed that the wheat leaves are more yellow with red stains near the top of each leaf. In December of 2020 you started collecting data in order to document patterns each year. For the past five years, during each of the four seasons, you have been counting the number of aphids on wheat plants scattered throughout your farm. The table below shows the average number of aphids per wheat plant every three months from December 2020 to September 2025.

Date	Number of aphids per plant
December 2020	0
March 2021	1
June 2021	4
September 2021	10
December 2021	0
March 2022	2
June 2022	7
September 2022	12
December 2022	0
March 2023	3
June 2023	11
September 2023	25
December 2023	0
March 2024	4
June 2024	15
September 2024	29
December 2024	0
March 2025	6
June 2025	19
September 2025	41

Make a graph with the date (months and year) on the *x* axis and the number of aphids per plant on the *y* axis. Plot this data on your graph. Draw a line to connect your data points.

1. What do you observe? What do see happening on your farm?

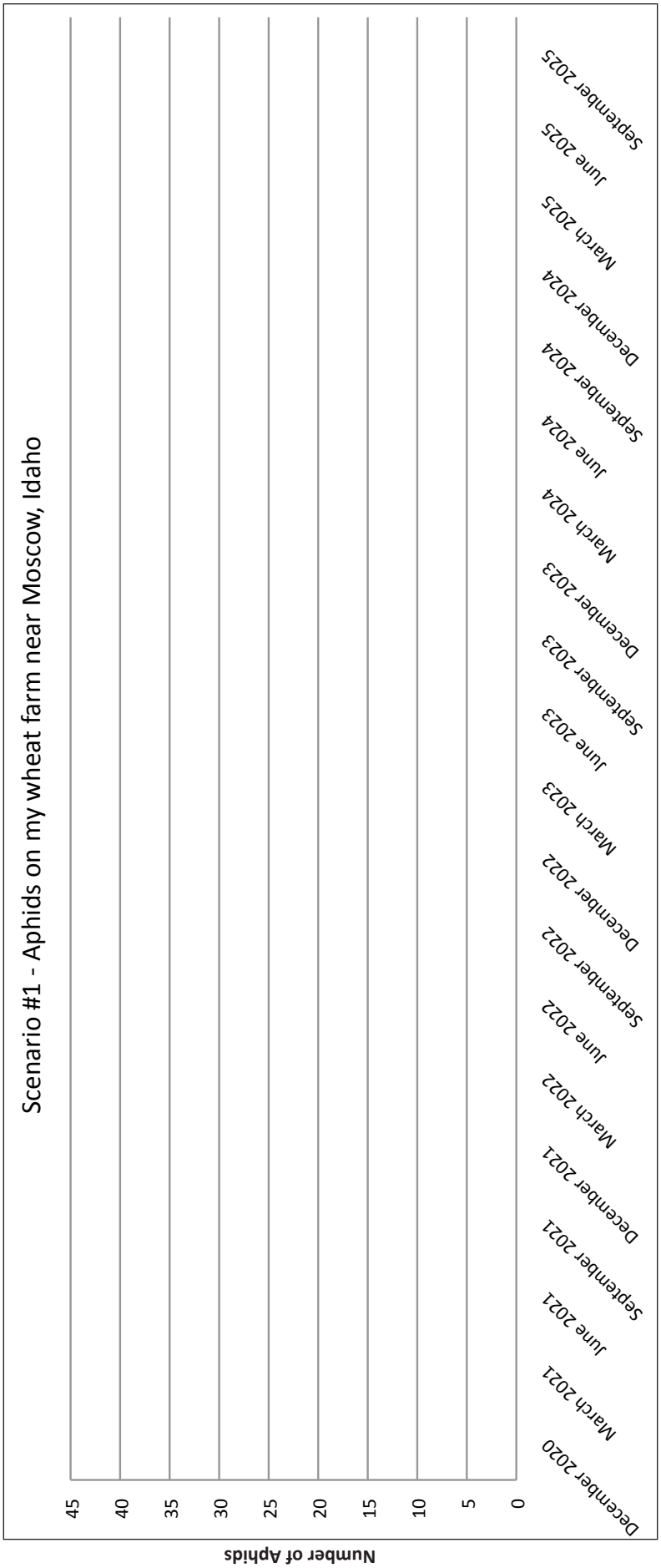
You also have the following yield data from each of these five years.

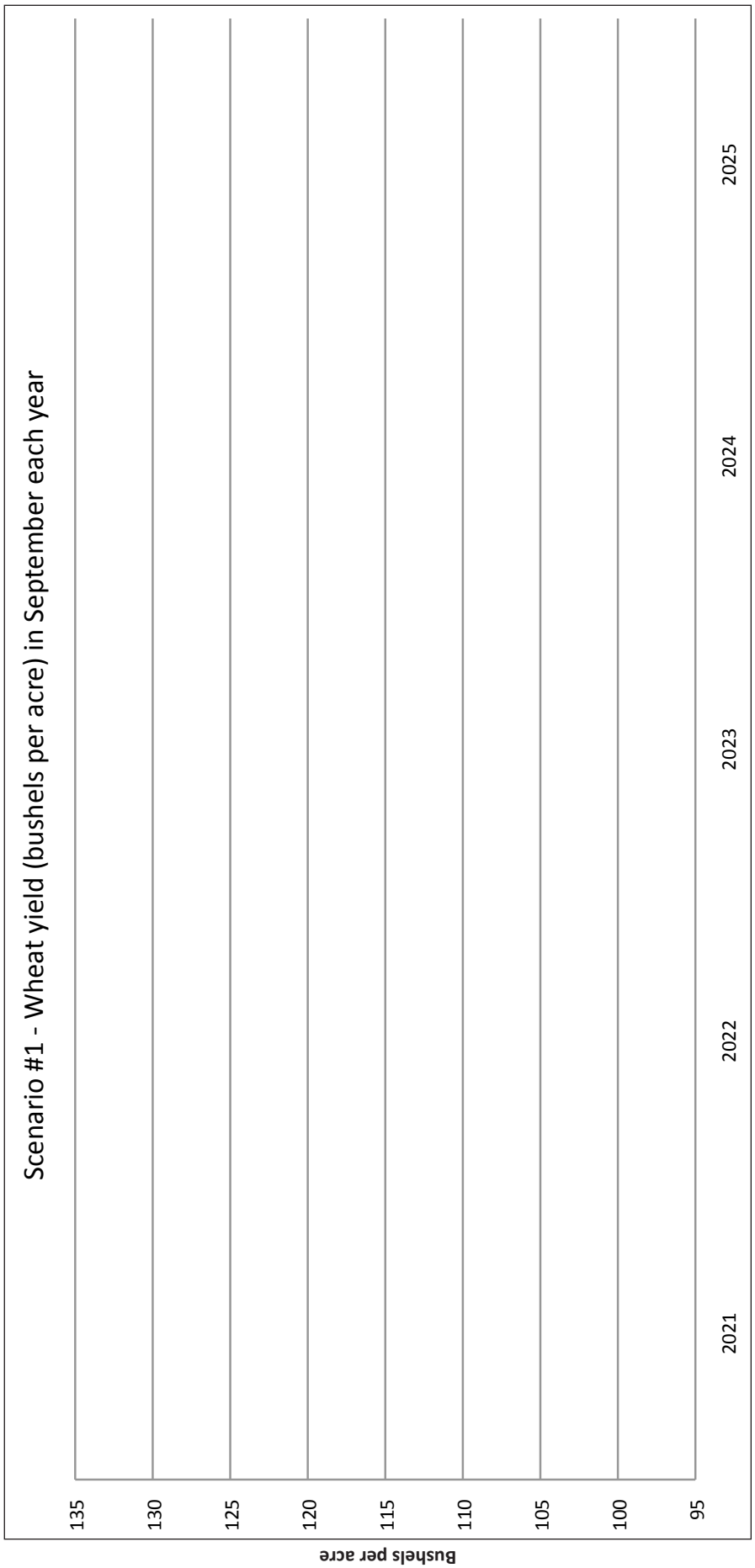
Date	Yield (bushels/acre)
September 2021	130
September 2022	127
September 2023	121
September 2024	116
September 2025	109

Draw a new *y* axis on the right side on your graph to show wheat yield (bushels/acre). Plot your wheat yield for each year. Use a differently colored marker to draw a line connecting your data points.

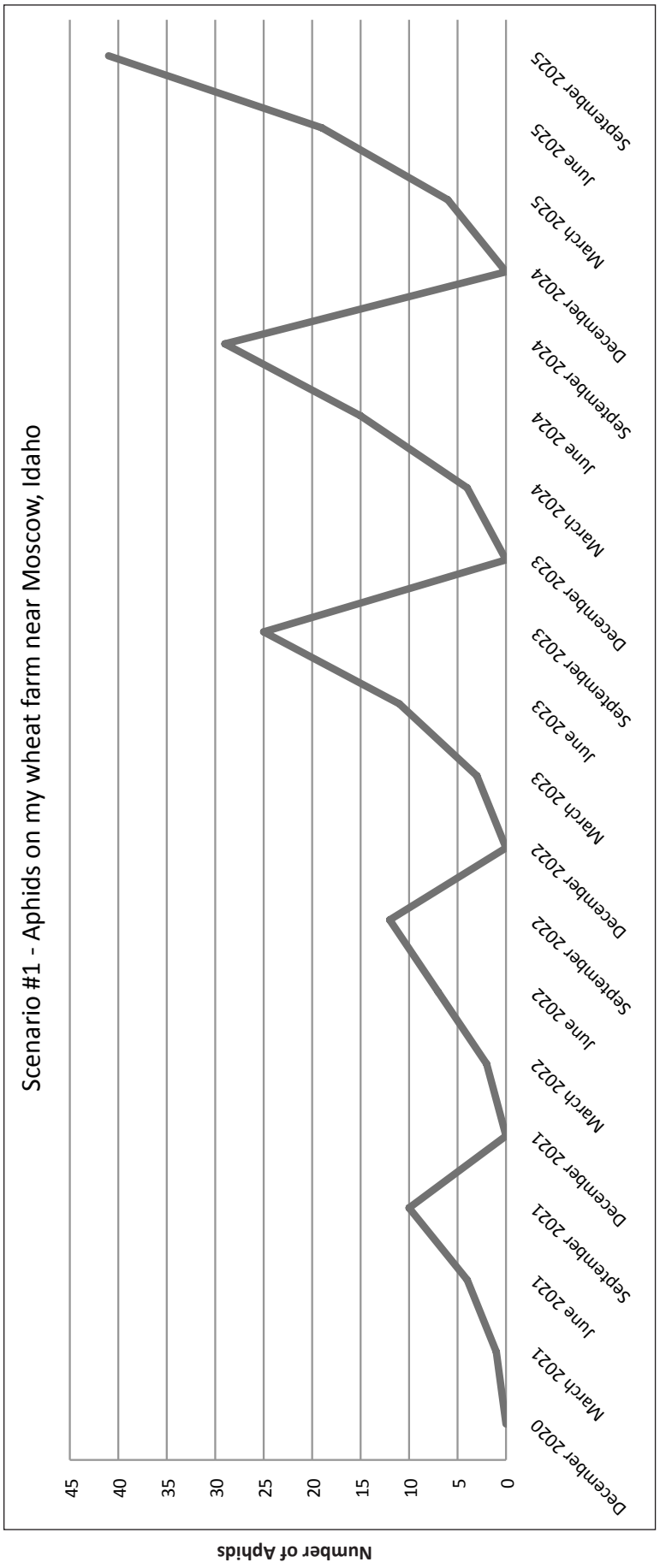
2. What do you observe from plotting this data? What do you see happening on your farm?

3. Why do you think you are seeing more aphids on your wheat?

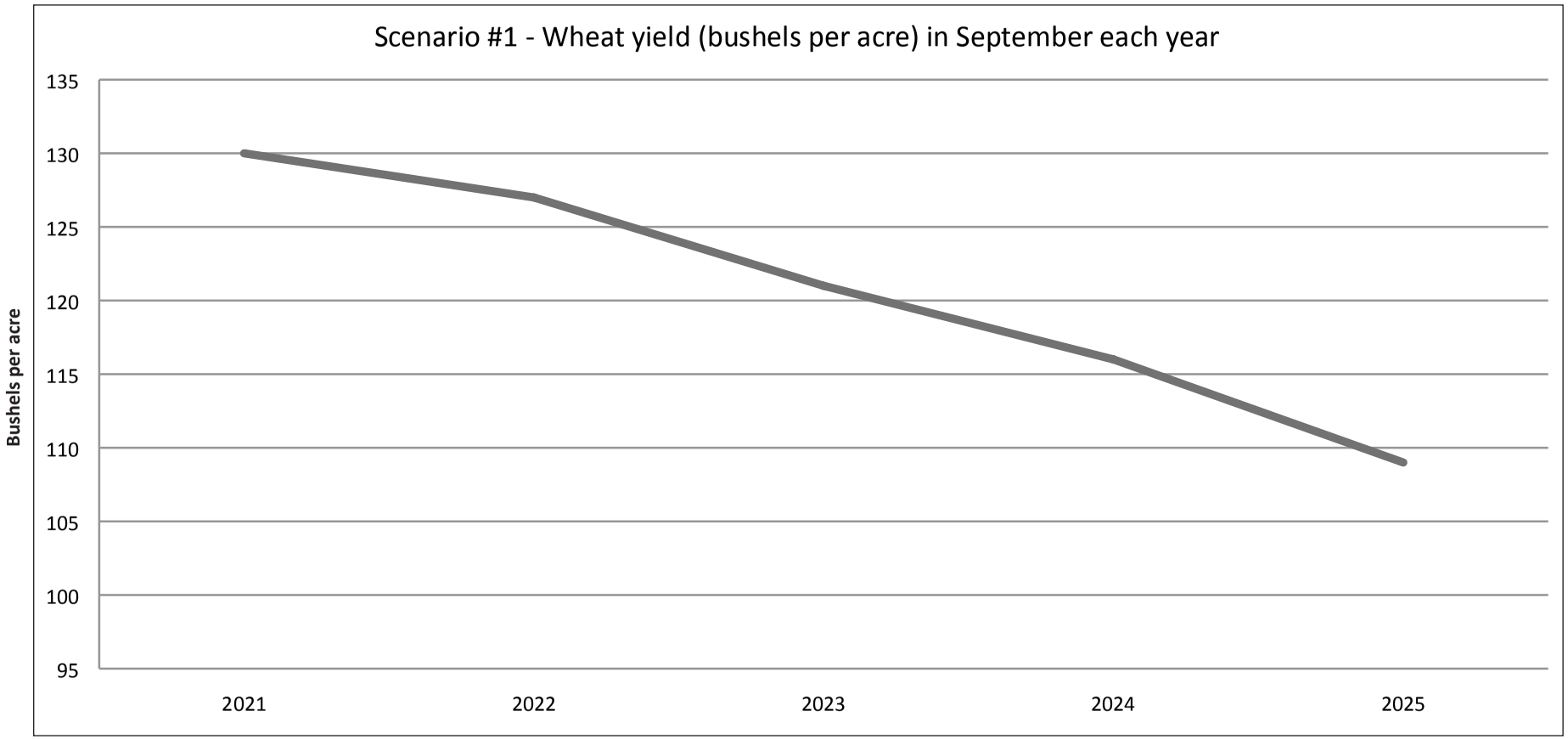

Scenario #1 - Aphids on my wheat farm near Moscow, Idaho
Number of Aphids
0
5
10
15
20
25
30
35
40
45
December 2020
March 2021
June 2021
September 2021
December 2021
March 2022
June 2022
September 2022
December 2022
March 2023
June 2023
September 2023
December 2023
March 2024
June 2024
September 2024
December 2024
March 2025
June 2025
September 2025


Scenario #1 - Wheat yield (bushels per acre) in September each year
Bushels per acre
135
130
125
120
115
110
105
100
95
2021
2022
2023
2024
2025

Teacher Key – Scenario 1



Teacher Key – Scenario 1



Scenario 2

What's Happening on My Wheat Farm in Oregon?

It is the year 2025. You are a wheat farmer in the inland Pacific Northwest region of the United States. For over thirty years you have been managing your family farm near Pendleton, Oregon. For the past several years you have noticed that your wheat plants don't grow as much as they used to and the soil seems very dry. You have also seen a consistent decline in yield (bushels per acre) each year. You have been working with scientists at Oregon State University to better understand what is happening on your farm and what you can do about it.

The table below shows two types of data that the Oregon State University scientists gave you. The middle column shows average high temperatures (in degrees Fahrenheit) during summer months (June to August) for every three years from 1998 to 2025. The right column shows the average potential evapotranspiration (in millimeters) during summer months (June to August) for every three years from 1998 to 2025. You were having a hard time understanding what "average potential evapotranspiration" means. The scientists explained to you that it is an estimate of how much water is lost from plants (through transpiration) and the soil (through evaporation) and that it depends on the weather conditions where the plant is growing.

Year	Average high temperature (˚F) in summer (June–August)	Average potential evapotranspiration (mm) in summer (June–August)
1998	82	650
2001	84	716
2004	86	1007
2007	88	947
2010	86	1043
2013	87	1009
2016	88	1101
2019	93	1417
2022	90	1139
2025	91	1223

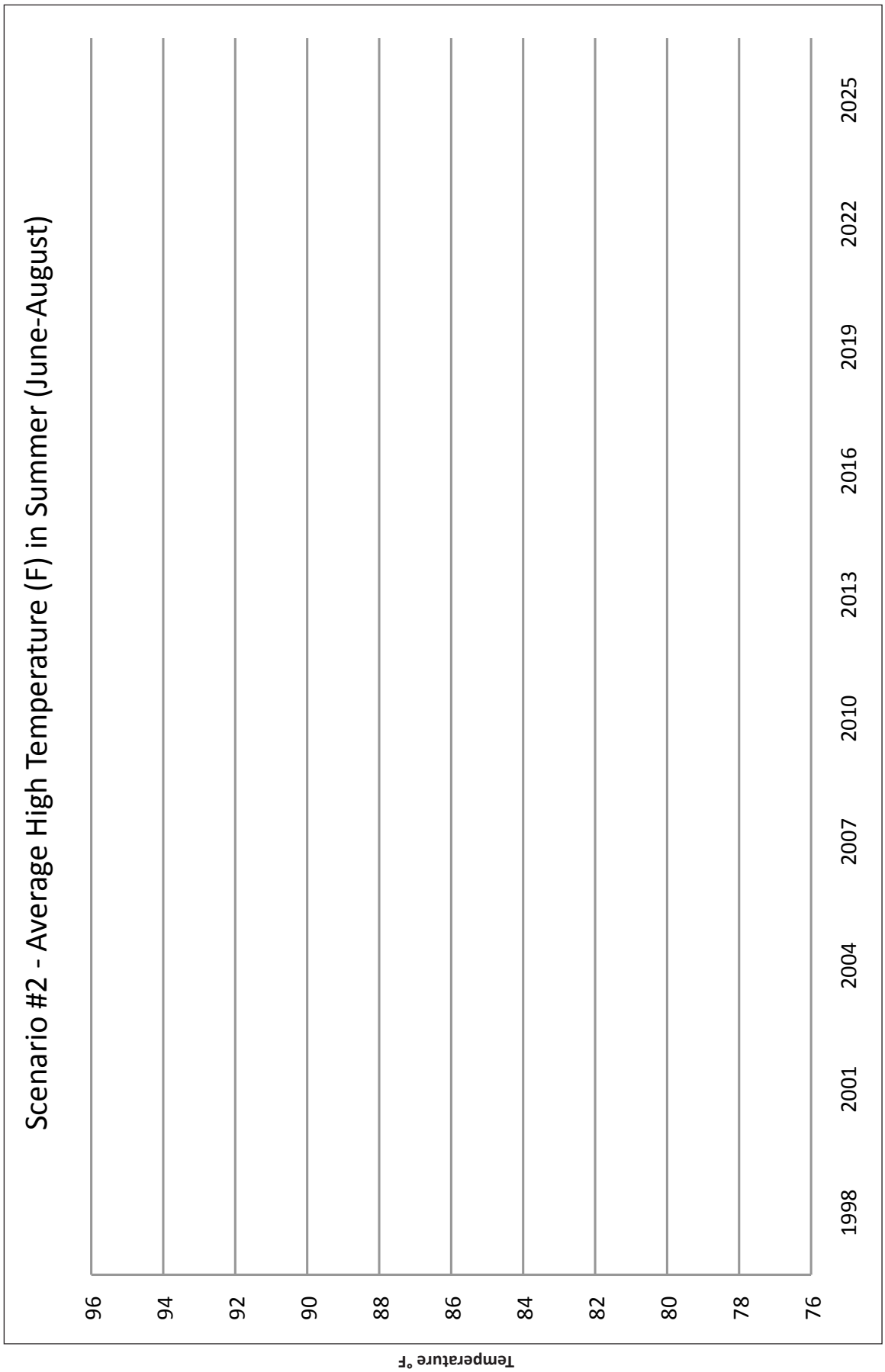
Make a graph with the date (months and year) on the *x* axis and the average high summer temperature on the *y* axis. Plot this data on your graph. Draw a line to connect your data points.

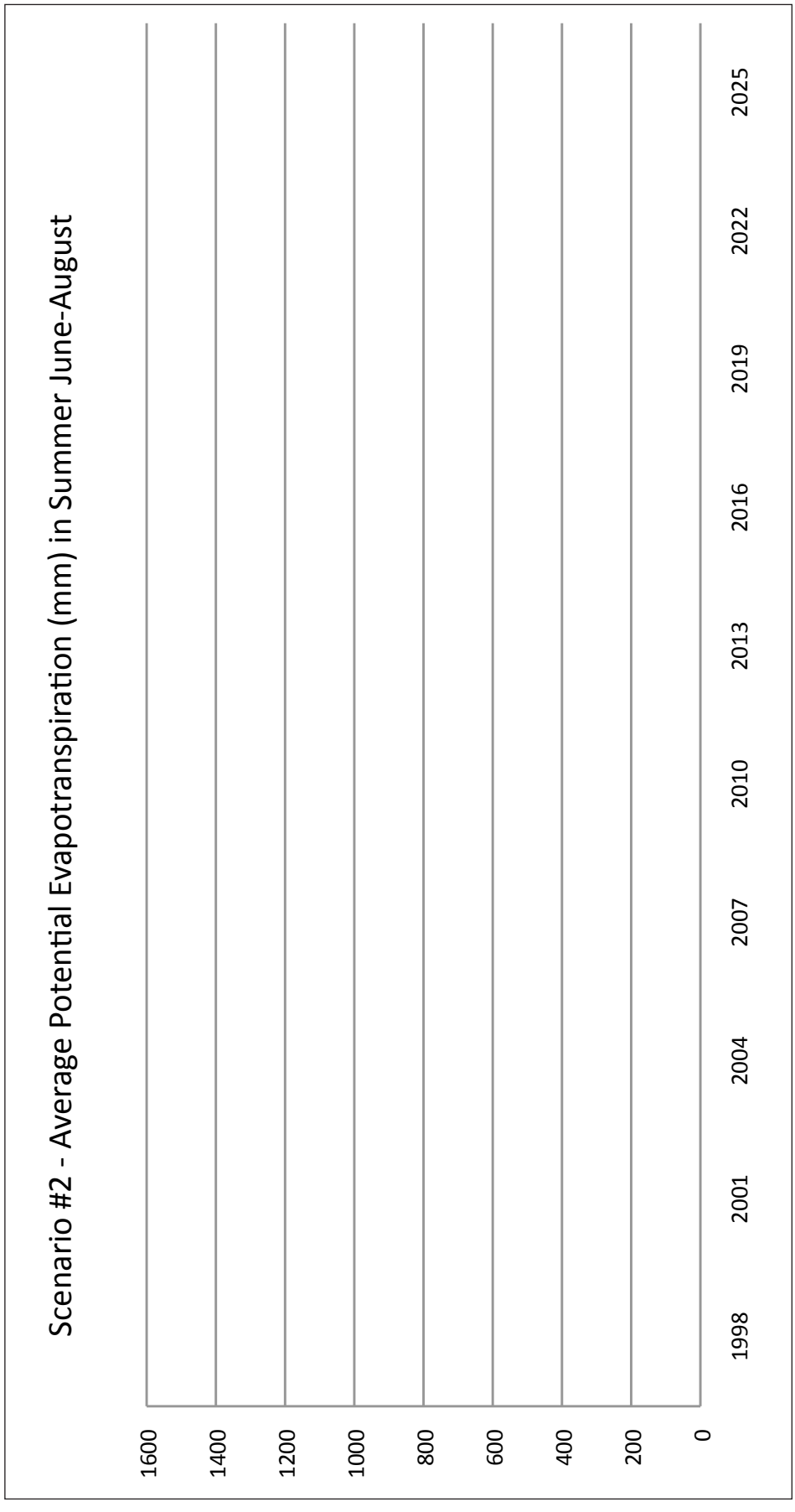
1. What do you observe? What do see happening on your farm?

Now draw a new *y* axis on the right side on your graph to show average potential evapotranspiration in millimeters. Plot your average potential evapotranspiration data. Use a differently colored marker to draw a line connecting your data points.

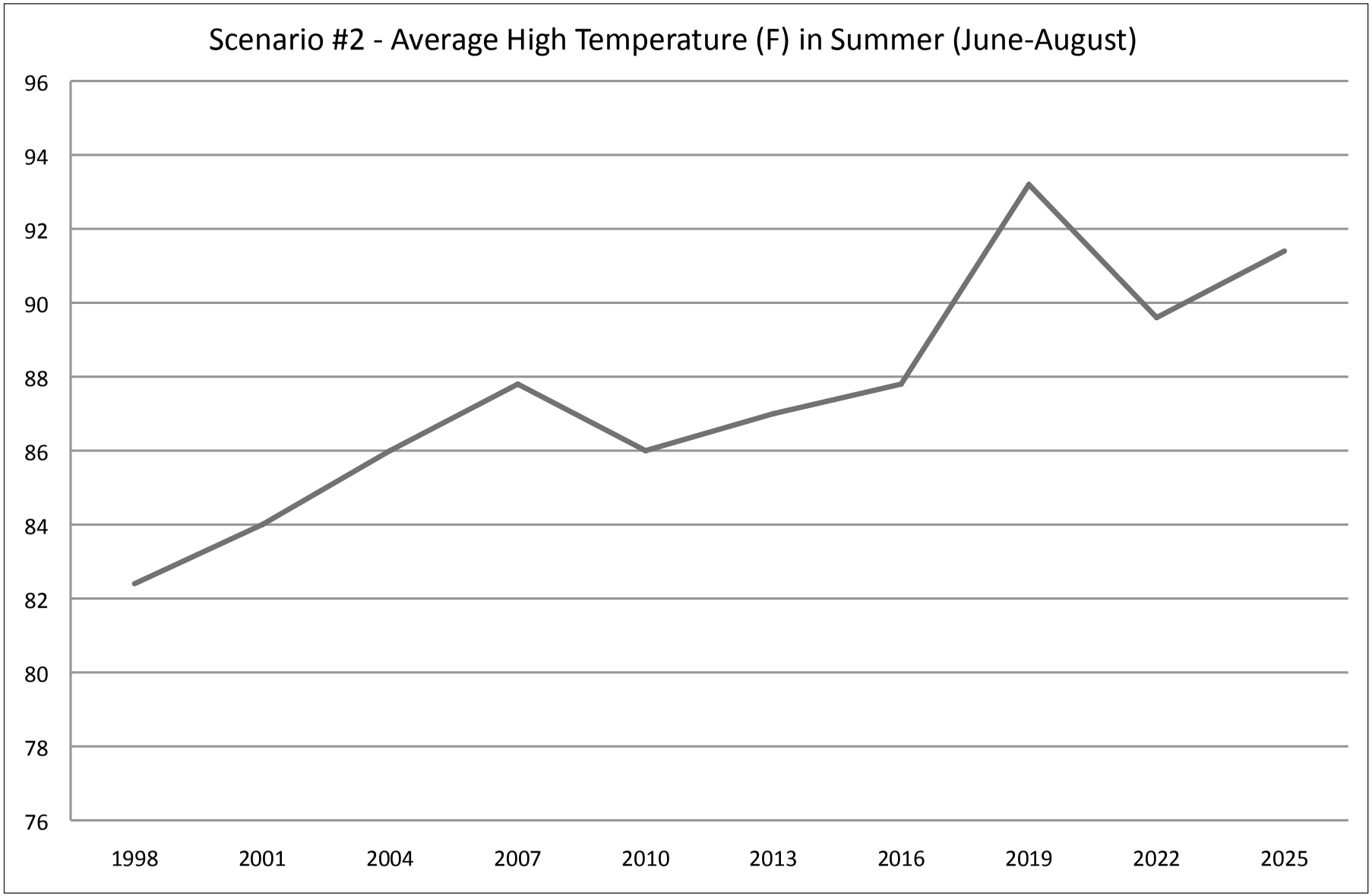
2. What do you observe from plotting this data? What do you see happening on your farm?

3. Why do you think your wheat has not been growing well?

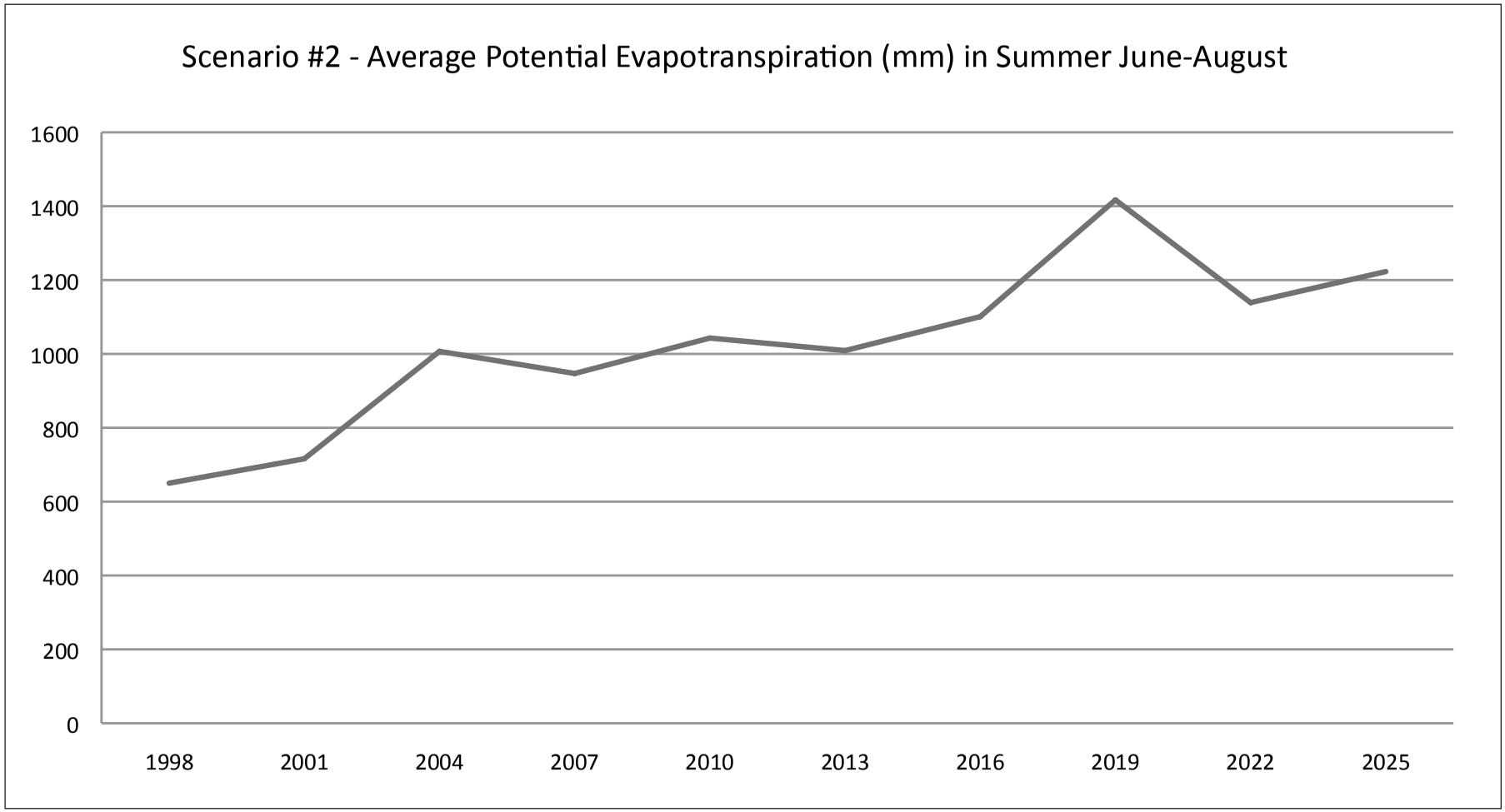

Scenario #2 - Average High Temperature (F) in Summer (June-August)
Temperature °F
96
94
92
90
88
86
84
82
80
78
76
1998
2001
2004
2007
2010
2013
2016
2019
2022
2025


Scenario #2 - Average Potential Evapotranspiration (mm) in Summer June-August
Millimeters
1600
1400
1200
1000
800
600
400
200
0
1998
2001
2004
2007
2010
2013
2016
2019
2022
2025

Teacher Key – Scenario 2



Teacher Key – Scenario 2



Scenario 3

What's Happening on My Wheat Farm in Washington?

It is the year 2025. You are a wheat farmer in the inland Pacific Northwest region of the United States. For over thirty years you have been managing your family farm near Walla Walla, Washington. For the past several years you have noticed that your wheat plants don't grow as much as they used to and you have seen a consistent decline in yield (bushels per acre) each year. For several years you have been frustrated because the ground is too wet in early spring to plant your wheat. Your tractor and seed drill get stuck in the mud. By the time the ground is dry enough to drive your plow and pull the seed drill, it is too late in the planting season. You have been working with scientists at Washington State University to better understand what is happening on your farm and what you can do about it.

The table below shows two types of data that the Washington State University scientists gave you. The middle column shows average low temperatures (in degrees Fahrenheit) during winter months (December to February) for every three years from 1998 to 2025. The right column shows the average precipitation as rain (in millimeters) during winter months (December to February) for every three years from 1998 to 2025.

Year	Average low temperature (˚F) in winter (December–February)	Average precipitation as rain (mm) in winter (December–February)
1998	28	89
2001	29	84
2004	30	94
2007	31	95
2010	32	103
2013	32	127
2016	32	119
2019	32	139
2022	33	122
2025	34	156

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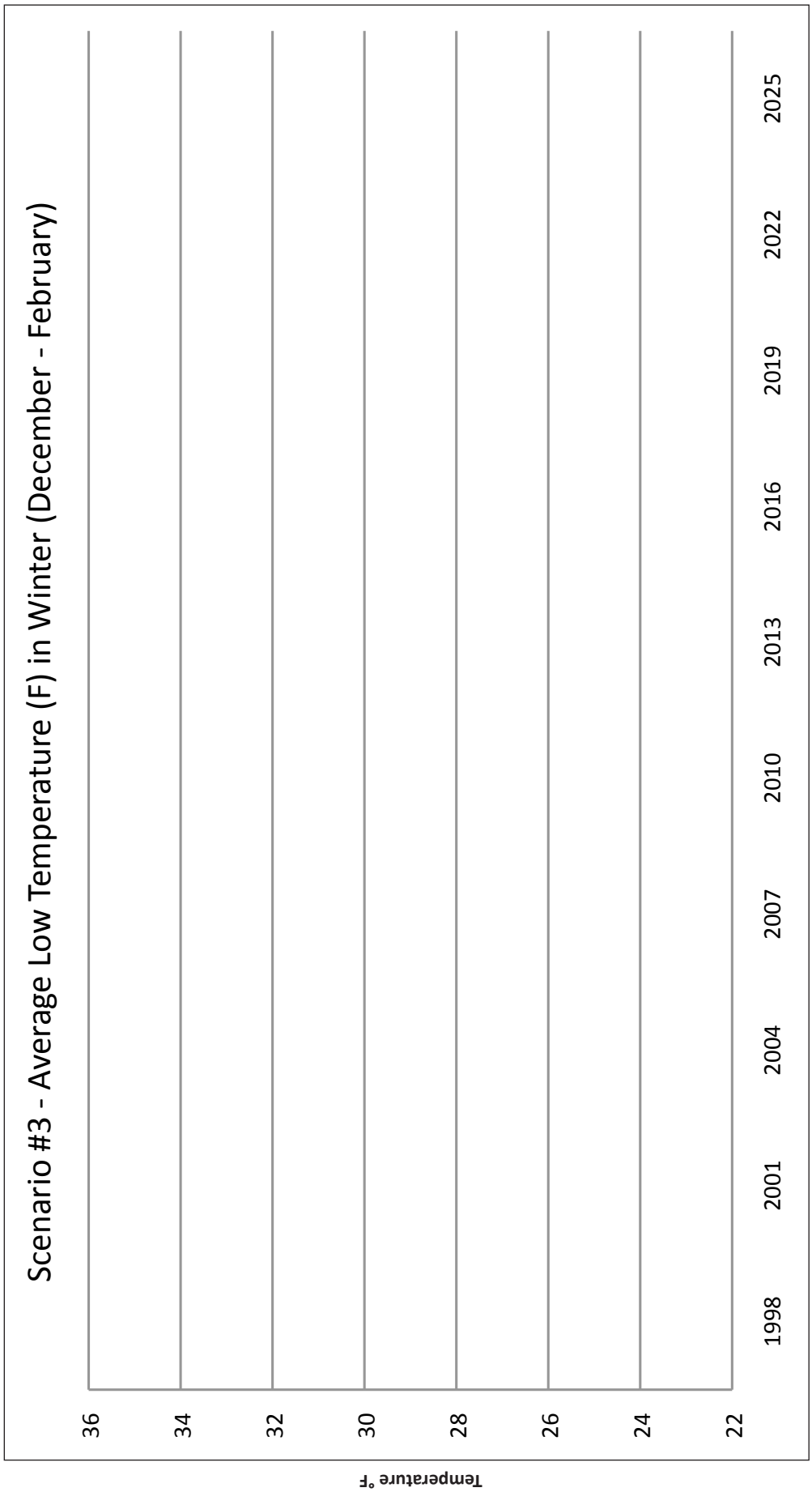
Make a graph with the date (months and year) on the *x* axis and the average low winter temperature on the *y* axis. Plot this data on your graph. Draw a line to connect your data points.

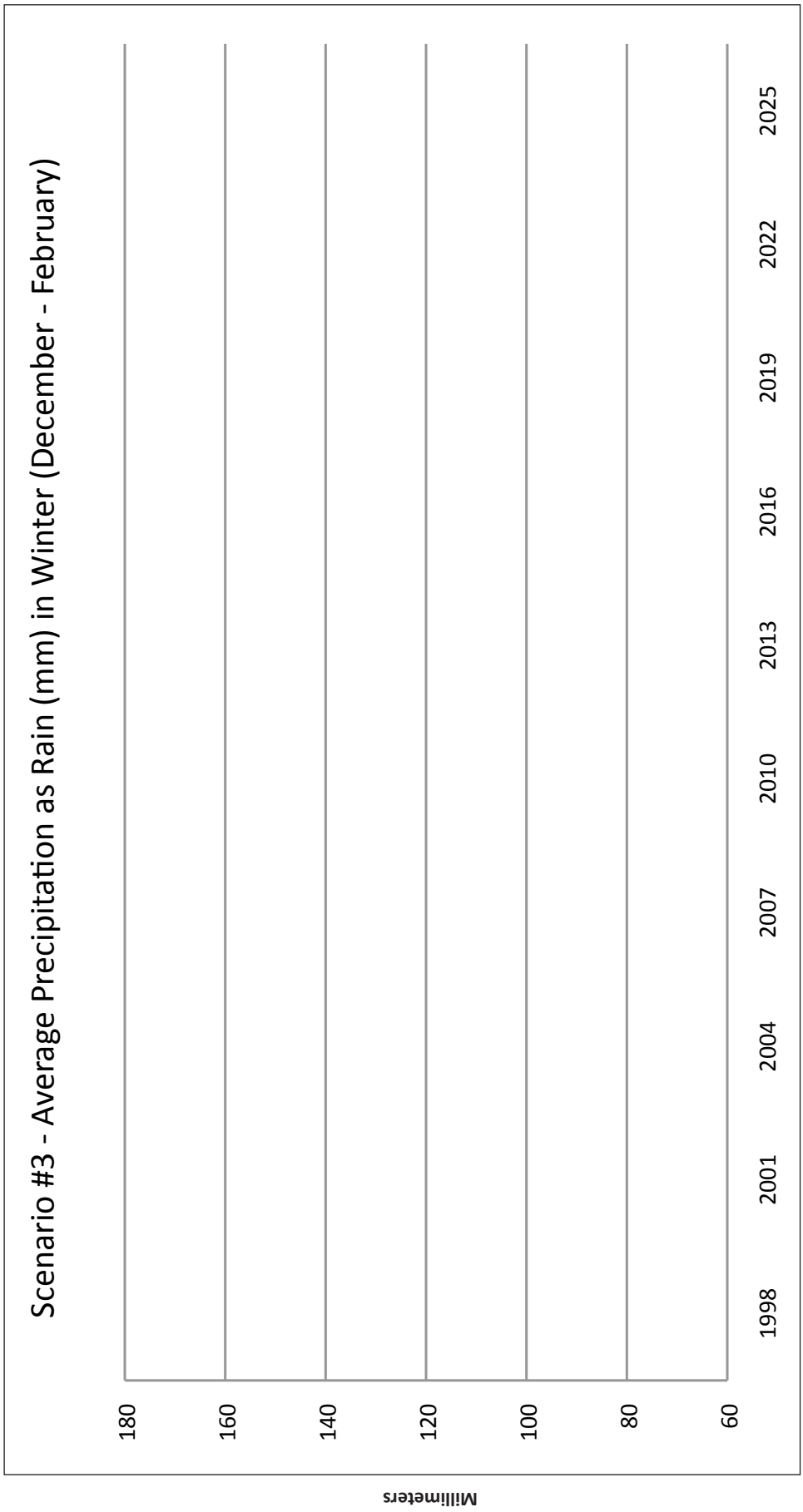
1. What do you observe? What do see happening on your farm?

Now draw a new *y* axis on the right side on your graph to show average precipitation as rain in millimeters. Plot your average precipitation as rain data. Use a differently colored marker to draw a line connecting your data points.

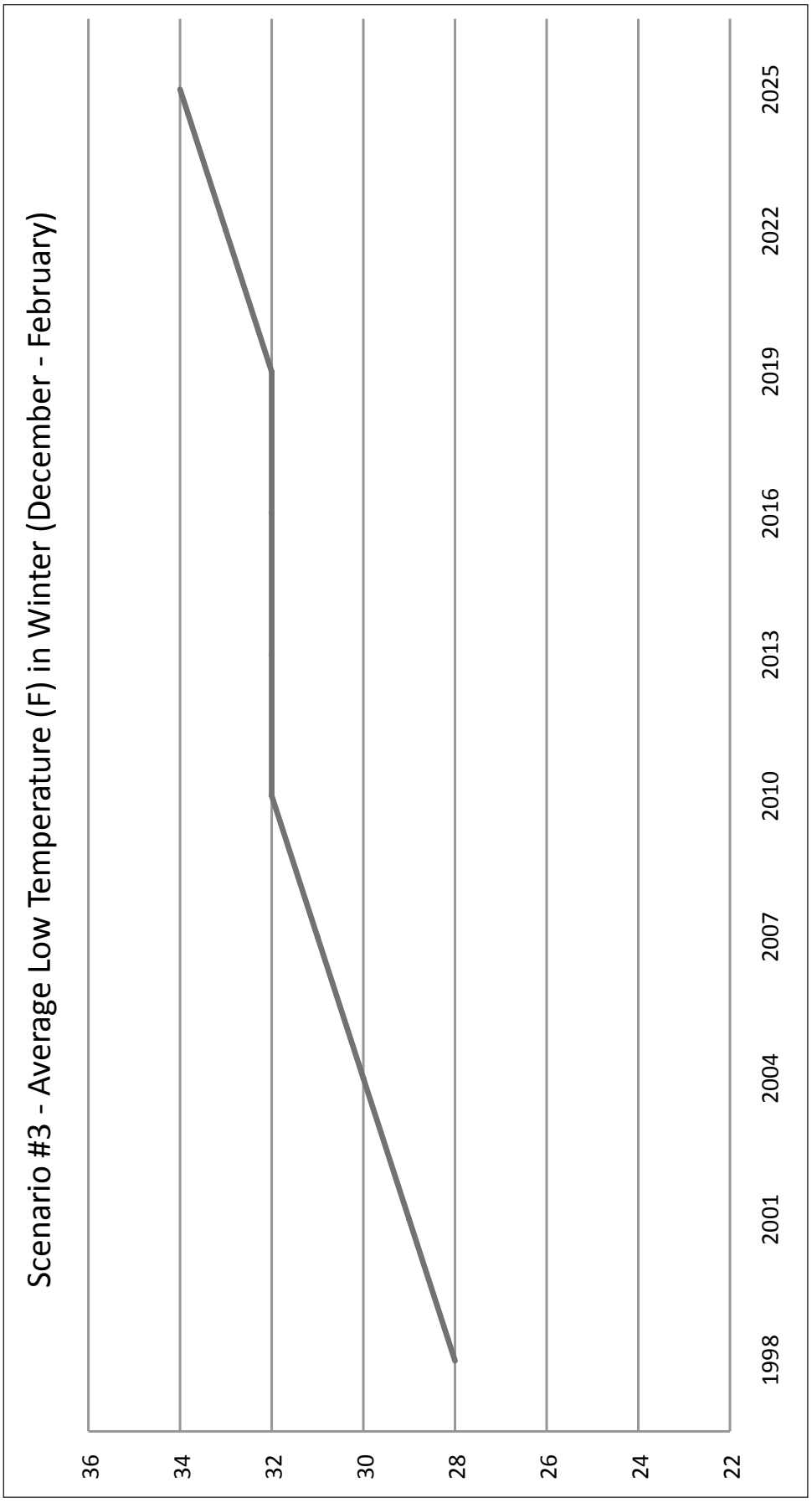
2. What do you observe from plotting this data? What do you see happening on your farm?

3. Why do you think the ground is too wet in early spring (April) to plant your wheat?


Scenario #3 - Average Low Temperature (F) in Winter (December - February)
Temperature °F
36
34
32
30
28
26
24
22
1998
2001
2004
2007
2010
2013
2016
2019
2022
2025


Scenario #3 - Average Precipitation as Rain (mm) in Winter (December - February)
Millimeters
180
160
140
120
100
80
60
1998
2001
2004
2007
2010
2013
2016
2019
2022
2025

Teacher Key – Scenario 3



Teacher Key – Scenario 3