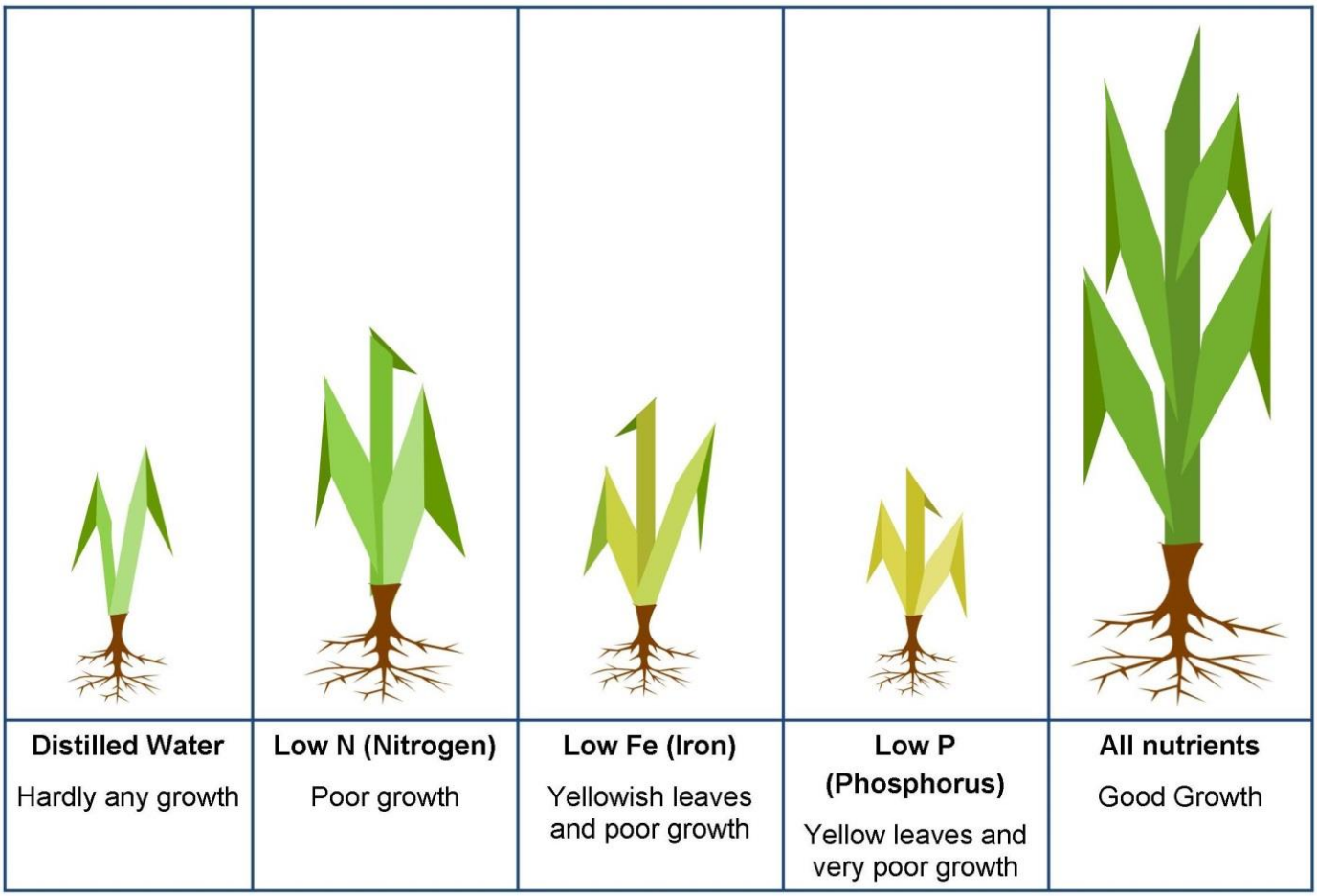
Conclusions-Evidence-Reasoning Guided Practice

Example 1: Nutrients in Hydroponics (with suggested responses)

Use the image below to practice using the Conclusions-Evidence-Reasoning strategy.

Inquiry Question: How do nutrients affect the growth of hydroponically grown corn plants?

1. Look carefully at the images below. What specific conclusions could you make about how nutrients affect corn plant growth?
2. What evidence is there in the pictures that would support your conclusions?
3. Explain your reasoning for making these conclusion(s) by connecting specific evidence in the pictures to the conclusions.



Distilled Water	Low N (Nitrogen)	Low Fe (Iron)	Low P (Phosphorus)	All nutrients
Hardly any growth	Poor growth	Yellowish leaves and poor growth	Yellow leaves and very poor growth	Good Growth

Practice Example 1: Nutrients in Hydroponics

Name/Group Members: Laura, Kim, Rosanna

Inquiry Question:

How do nutrients affect the growth of hydroponically grown corn plants?

Conclusion(s): Answer the inquiry question and relate it to the dependent and independent variables

Corn plants grown hydroponically need a mixture of all nutrients in order to grow well. Growing plants with any key elements missing leads to less growth.

Evidence: Describe the specific observations and data that support the conclusion(s).

- Plants grown with distilled water alone (no added nutrients) had hardly any growth
- Plants grown with nitrogen deficiency had slightly better growth than water alone
- Plants grown with iron deficiency had yellow leaves and minimal growth
- Plants grown with magnesium deficiency had yellow leaves and moderate growth
- Plants grown with phosphorus deficiency had yellow leaves and very little growth
- Plants grown with all nutrients (nitrogen, iron, magnesium, phosphorus) had large, green leaves and healthy growth.

Reasoning: Explain your reasoning by connecting the evidence to the conclusion(s), as well as to known scientific rules and principals.

- Macroelements are elements that plants require in large quantities – these include nitrogen, phosphorus, potassium, calcium, magnesium and sulfur
- Microelements are elements that plants require in smaller amounts – these include boron, chlorine, copper, iron, manganese, molybdenum, nickel and zinc
- **Nitrogen** - is necessary for cell division, photosynthesis, formation of amino acids
- **Iron** – formation of chlorophyll, cell division and growth
- **Magnesium** - production of chlorophyll, part of plant enzymes, helps plants use iron
- **Phosphorus** – photosynthesis and respiration, cell division, root formation and growth, seed formation, use of water by plant
- Plants require all macronutrients and micronutrients for optimum growth

References:

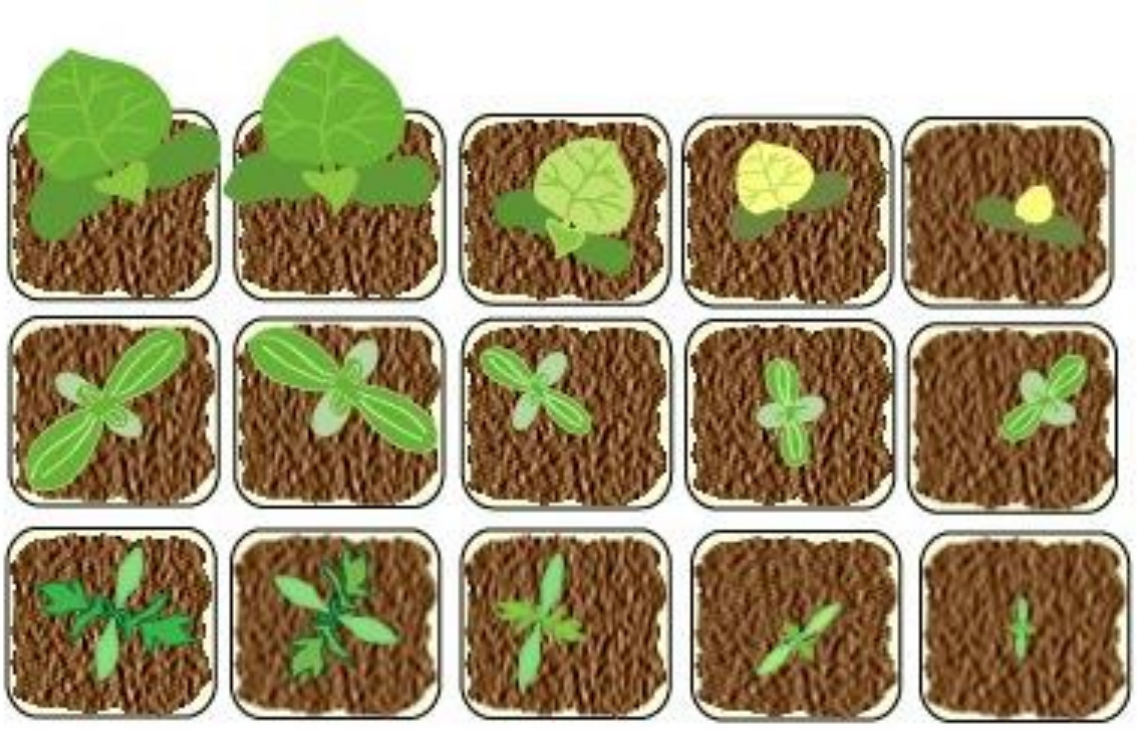
- http://balkanecologyproject.blogspot.ca/2013/09/plant-nutrients.html
- http://www.cropnutrition.com/nutrient-knowledge

Example 2: The Effects of Fertilizer

Use the image below to practice using the Conclusions-Evidence-Reasoning strategy.

Inquiry Question: How does the amount of fertilizer affect the size of plants?

1. Look carefully at the images below. What specific conclusions could you make about how fertilizer affects plant growth?
2. What evidence is there in the pictures that would support your conclusions?
3. Explain your reasoning for making these conclusion(s) by connecting specific evidence in the pictures to the conclusions.



Fertilizer – left to right – none, 1 tbsp. fertilizer per gallon of water, 2 tbsp. fertilizer per gallon of water, 3 tbsp. per gallon of water, 4 tbsp. per gallon of water

Plant Types – top to bottom - Musk melon, Zinnia, tomato

Guided Practice

Example 3: Type of substrate

Use the image below to practice using the Conclusions-Evidence-Reasoning strategy.

Inquiry Question: How does the material in which a tomato plant is grown in affect its growth?

1. Look carefully at the images presented below. What specific conclusions could you make about how the substrate affects plant growth?
2. What evidence is there in the pictures that would support your conclusions?
3. Explain your reasoning for making these conclusion(s) by connecting specific evidence in the pictures to the conclusions.

Figure: Tomato plants grown in different wood substrates.

From left to right the substrates are peat, Sycamore, Red maple and Loblolly Pine.

Source: Brian E. Jackson, Associate Professor, Ornamental Horticulture, NCSU. For more information see: https://www.ncsu.edu/project/woodsubstrates/topics/tree-species.html