GROWING AMERICA

Macromolecules in crops

Focus questions	What are the differences in macromolecules of different crops? What effect do those differences have on their uses?
Vocabulary	Monosaccharide, starch, protein, lipid

Materials

- Corn flour
- Soybean flour
- Corn seeds
- Soybean seeds
- Whole-grain flour
- Old-fashioned oats
- Wheat seeds
- Benedict's solution
- Sudan III
- Iodine
- Protein strips or Biuret solution
- Coffee grinder
- Balance
- Distilled water
- Mortar and pestle
- Filter paper
- Funnel
- Small beaker
- Test tube
- Test tube holder
- Hot plate
- Cell well plate
- Beaker with water for water bath
- Vortex (optional)

Procedure

Macromolecule testing

1. Weigh out 5g of sample using an electronic balance. Place sample into a mortar.
2. Add 20 mL of distilled water to the food sample in the mortar. Grind sample with a pestle into a slurry.
3. Filter slurry using filter paper and funnel. Collect liquid food sample into a small graduated cylinder or beaker.
4. Use the filtrate to complete the Carbohydrate Indicator Tests and the Protein Indicator Test.

Monosaccharide indicator standard test (glucose)

1. Add 2 mL of food sample solution with 2 mL of Benedict's solution in a test tube.
2. Use Vortex to give sample a quick mix (or cover with parafilm and invert test tube). Record sample color in data chart.
3. Place test tube containing food sample and Benedict's solution in a boiling water bath and heat for 2 minutes. Record sample color in data chart.
4. The glucose present in the solution reacts with the copper sulfate in the Benedict's reagent creating copper oxide, which results in an orange to red-brick precipitate. The intensity of the color depends on the concentration of glucose present in the sample.
5. Rate the precipitate color change and record sample data in the chart.
   0: no color change/negative, 1: weak/positive, 2: strong/positive, 3: very strong/positive

Complex carbohydrate indicator standard test (starch)

1. Add 1 mL of food sample solution with 1 drop of Lugol's iodine solution in a test tube or cell well plate.
2. Use a vortex to give the sample a quick mix (or cover with parafilm and invert test tube). Do not heat!
3. A bluish-black color indicates a positive test for starch.
4. Rate the precipitate color change and record sample data in the chart.
   0: no color change/negative, 1: weak/positive, 2: strong/positive, 3: very strong/positive
5. Keep the sample to observe until day 3 of the lab.

Protein indicator standard test

1. Add 1 mL of food sample solution in a test tube or cell well plate. Dip a protein test strip into the filtrate to compare to the color chart on the bottle.

Lipid indicator test

1. Label the test tubes or cell well plates with sample names.
2. Add 1 mL of sample to corresponding labeled tubes or wells.
3. Record the color of each sample.
4. Add 1 drop of Sudan III to each sample. A bright red color indicates the presence of lipids.

Reflection

1. Create a data table that compares the relative amounts of sugar, starch, lipid, and protein in each crop.

2. What differences did you find?

3. Create an "infographic" that shows the relative amounts of each macromolecule.

Rubric for self-assessment

Skill	Yes	No	Unsure
I generated data to compare nutrient content differences between corn and soybeans.			
I can explain why corn is used for ethanol production, why soybeans are used for biodiesel, and the main uses of wheat and oats.			