

Let's calculate what we eat

SUMMARY INFORMATION

Keywords

Nutrition, Nutritional composition, legumes

Topics Covered

Biology

Target Grade(s)

6, 7, 8

Estimated Time Required

1 week

LESSON

Goals and Pre Requisites

Goals

- To harvest simple leguminous plants as a means of nutritional supplement.
- To promote the concept of organic farming.

Pre Requisites

Knowledge on basic nutritional requirements.

Instructional Objectives

Students would develop:

- Research based learning
- Quantitative thinking and analysis

Instructional Resources

Problem Statement

We are aware of the usage of chemical fertilizers and pesticides to promote growth of plants. As a result, the fruits and vegetables grown are depleted of their natural nutrient content. How can we grow any one of the leguminous plants so that we would be able to keep its nutritional composition intact?

Background

Plant Nutrition

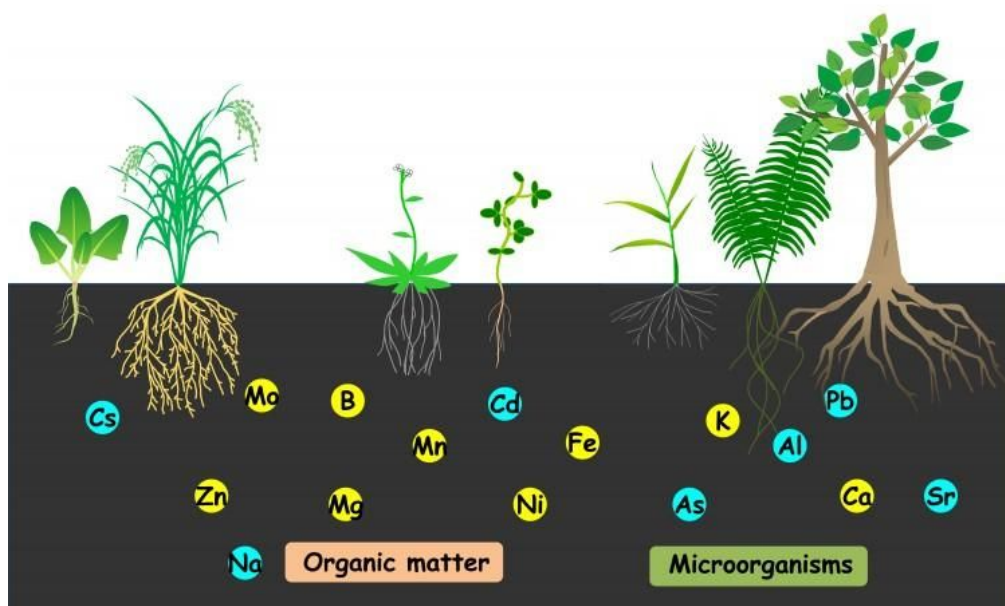
Plant nutrition is the study of the chemical elements and compounds necessary for plant growth, plant metabolism and their external supply. In 1972, E. Epstein defined two criteria for an element to be essential for plant growth:

1. In its absence the plant is unable to complete a normal life cycle.
2. That the element is part of some essential plant constituent or metabolite.

The essential plant nutrients include carbon and oxygen which are absorbed from the air, whereas other nutrients including hydrogen are typically obtained from the soil.

Plants must obtain the following mineral nutrients from their growing medium:

- **Macronutrients:** nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), sulfur (S), magnesium (Mg); and
- **Micronutrients:** boron (B), chlorine (Cl), manganese (Mn), iron (Fe), zinc (Z), copper (Cu), molybdenum (Mo), nickel (Ni).



The macronutrients are consumed in larger quantities and are usually present in plant tissue in concentrations of between 0.2% and 4.0% (on a dry matter weight basis). Micronutrients are present in plant tissue in quantities measured in parts per million, ranging from 0.1 to 200 ppm, or less than 0.02% dry weight.

Most soil conditions across the world can provide plants adapted to that climate and soil with sufficient nutrition for a complete life cycle, without the addition of nutrients as fertilizer. However, if the soil is cropped it is necessary to artificially modify soil fertility through the addition of fertilizer to promote vigorous growth and increase or sustain yield. This is done because, even with adequate water and light, nutrient deficiency can limit growth and crop yield.

Importance of eating Nutritious Food

1. Weight Control

A diet that is full of fruits, vegetables, lean proteins and whole grains can help you lose, maintain or control your weight. Replace high-fat and high-calorie foods with nutrient rich items. The fibre in fruits, vegetables and whole grains will keep you fuller for longer while proteins will provide you with cellular support.

2. Blood Sugar Control

Sugary foods cause spikes in your blood sugar. If you consume too many sugary foods like white breads and concentrated fruit juices, over time

you can develop Type 2 diabetes. Complex carbohydrates, like those in oatmeal, can help reduce and regulate blood sugar.

3. Cardiac Health

High-fat foods cause high cholesterol and a build-up of plaque in your arteries. It's a known fact that this can lead to stroke, heart attack or heart disease. Eat healthy fats, like those found in nuts and avocados, to get the fat you need without the plaque build-up.

4. Decreased Cancer Risk

Fruits and vegetables are full of antioxidants that help neutralize the damaging cells known as free radicals. Free radicals are highly unstable and can lead to cancerous cells. Antioxidants create a stable cell environment.

Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before constructing it. Students must be able to provide justification for their choice of materials.
6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.
7. Students must make sure that the design incorporated in their process would address the existing problem.
8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required

Mung seeds

Container – preferably plastic with lid

Water

Linen cloth (for sprouting)

Thermometer

Procedure

1. Begin by having students research on the nutritional benefits of sprouts derived from mung beans. How many sprouts would be required to meet the nutritional needs for a child?



Nutritional Value of Sprouts

Raw Sprouts (1 cup)	Calories	Protein (grams)	Fiber (%)	Vitamin C D a i l y	Iron V a l u e	Folate
Alfalfa	10	1.3	3	5	2	3
Mung Bean	26	2.5	4	23	4	9
Radish	16	1.4	n/a	18	2	9
Soybean	86	9.0	3	17	8	30
Wheat	214	8.0	4	5	11	10

(Source: U.S. Department of Agriculture)

2. For indoor planting, it is essential to use a container that has a drainage hole in the bottom, as mung bean plants will drown when soaked in too much water. A large clay pot, wooden barrel or other similar container serves well.
3. Place at least three to five inches (7–12 cm) of soil in the container and make sure that the soil has a neutral pH, from 6.2 to 7.2, to promote healthy sprout growth. Water the newly planted beans to provide

preliminary moisture for germination. Do not overwater. Mung beans will not do well on oversaturated and soggy soil.

4. Cover the container with a lid, such as a plastic garbage can lid, newspaper, or planter bottom. This will help keep the soil and seeds slightly moist, and will promote the development of sprouts.
5. Mung Bean sprouts should be seen after about a week; the warmer the temperature, the faster the seed germination.
6. Place the seedlings in a sunny location to encourage faster growth. It is not advisable for the plants to be watered frequently; wait until the soil becomes dry before watering.



7. Students can research on the optimal intake requirement to provide a daily requirement of nutrients and compare it to the nutritional offerings of the sprouts. Based on the nutritional needs, how many such sprouts would be required?



Extension

- Students may research on how to grow different leguminous plants.
- Can develop a nutrition meter and try calculating nutrient intake on a daily basis.

Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities brainstorm on various ideas before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

- Mother Earth News

<http://www.motherearthnews.com/organic-gardening/growing-sprouts-at-home-zmaz77zbon.aspx>

- Emanuel Epstein. Mineral Nutrition of Plants: Principles and Perspectives
- <http://books.google.com/books?id=5k0afN5UZ4IC&pg=PA4>
- <http://aesl.ces.uga.edu/publications/plant/Nutrient.htm>
- Marschner, Petra, ed. (2012). Marschner's mineral nutrition of higher plants (3rd ed.)
- Tree Hugger

<http://www.treehugger.com/green-food/grow-your-own-sprouts-jar.html>

- Gardeners HQ

<http://www.gardenershq.com/Growing-Mung-Beans.php>

- <http://cf.ltkcdn.net/garden/images/std/138556-425x253-lifecyclebeanplant.jpg>
- <http://www.agr.hokudai.ac.jp/en/spgp/lab/plant-nutrition/>
- <https://sproutpeople.org/growing-sprouts/>

- <http://steadyrun.com/health-tips/food/health-benefits-of-bean-sprouts/>
- <http://www.thedynamicturnaround.com/superfoodsprouts.htm>