

Supplying Nutrients to Crops

What is Plant Nutrition?

- Plants need **nutrients** for healthy growth and development.
- **Plant nutrition** involves the absorption of nutrients for plant growth and is dependent on **16 essential elements**, often referred to as nutrients.



What is Plant Nutrition?

- Three of the 16 elements comprise 89 percent of a plant's tissue by dry weight: oxygen (O), hydrogen (H), and carbon (C).
- They are considered to be non-fertilizer nutrients as we can NOT buy these.
- The plant acquires these three elements through natural processes from air and water.

What is Plant Nutrition?

Six essential elements in addition to oxygen, hydrogen, and carbon are required in greater quantity than the others; they are called ***macronutrients***.

- The macronutrients are **nitrogen (N)**, **phosphorus (P)**, **potassium (K)**, **calcium (Ca)**, **magnesium (Mg)**, and **sulfur (S)**.

What is Plant Nutrition?

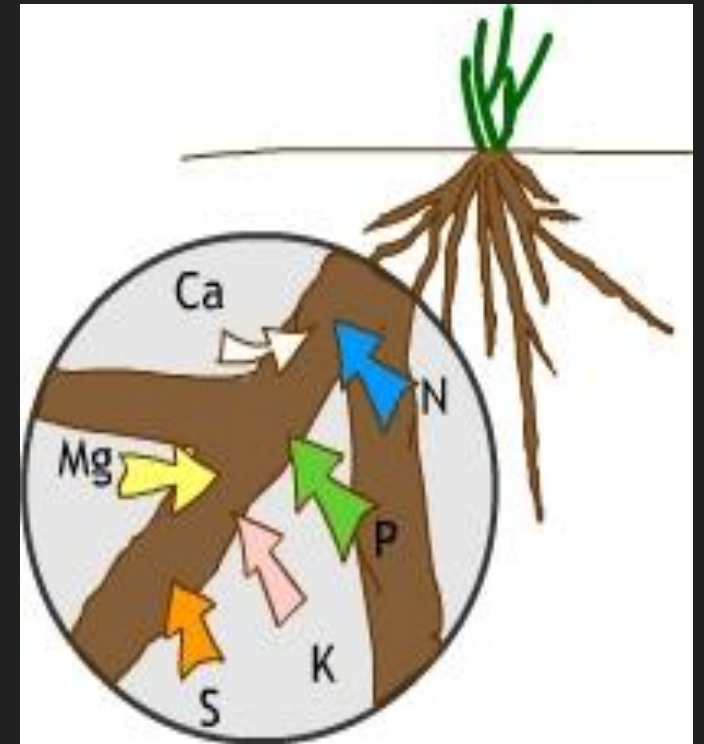
1. Nitrogen, phosphorus, and potassium are considered **primary macronutrients** because they are used in complete fertilizers.

- Nitrogen promotes **green leafy growth**.
- Phosphorus encourages **flowering and root growth**.
- Potassium provides **disease resistance**.

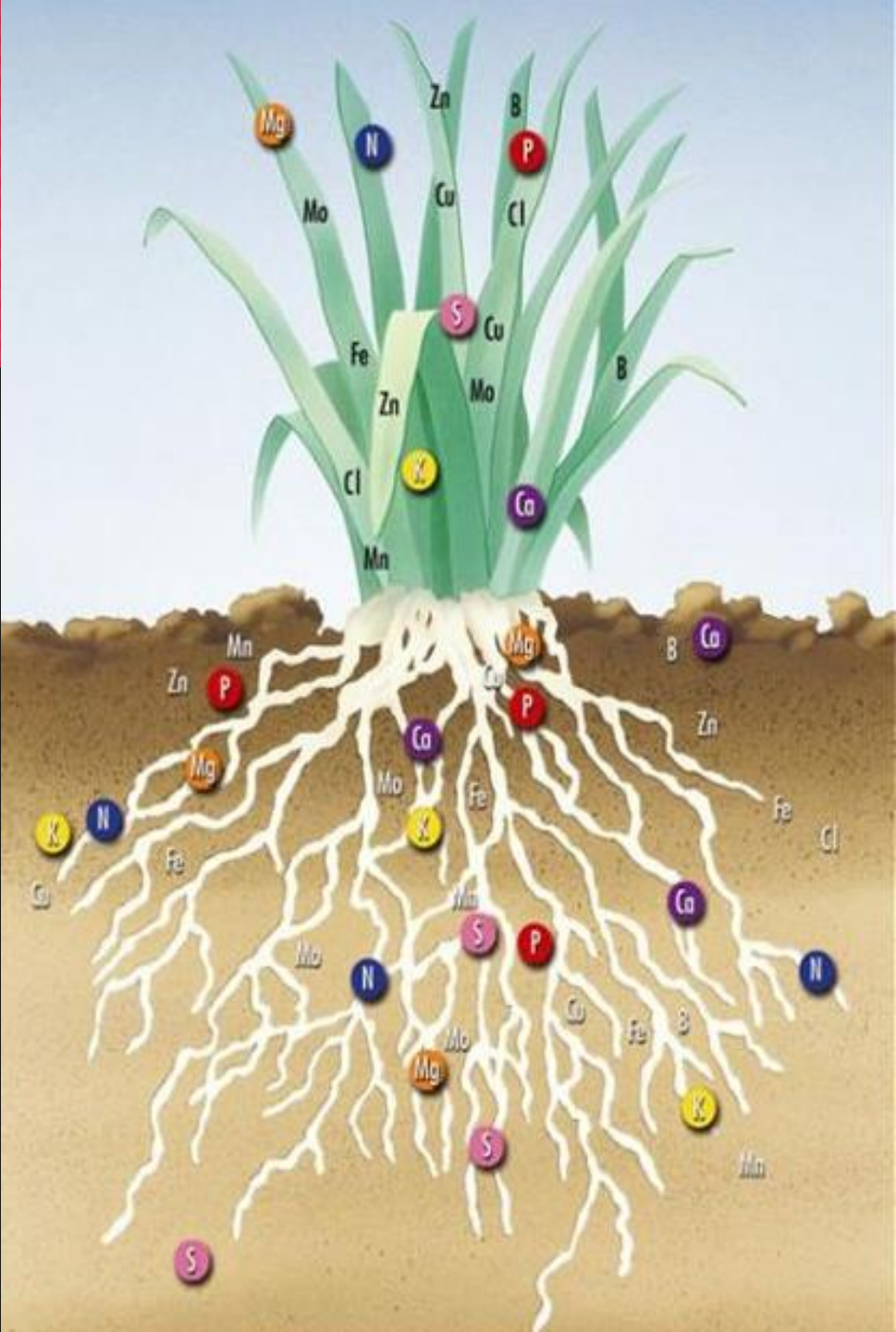
What is Plant Nutrition?

○ 2. Calcium, magnesium, and sulfur are said to be **secondary macronutrients** because plants need them in moderate amounts.

○ These secondary macronutrients may or may not be used in complete fertilizers.



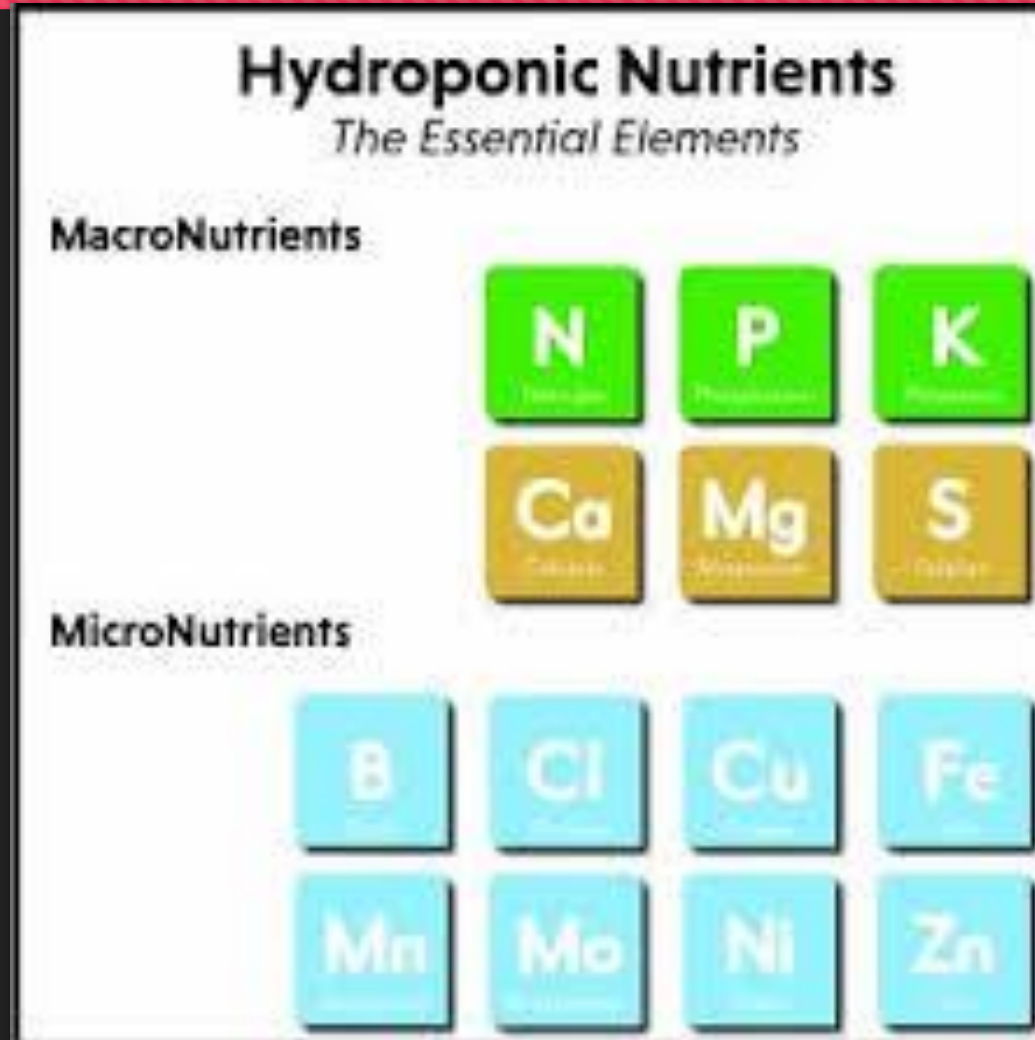
Nutrients



What is Plant Nutrition?

- The other seven essential elements, called **micronutrients**, are needed in small quantities.
- These are sometimes called trace elements. They are **boron (B), copper (Cu), chlorine (Cl), iron (Fe), manganese (Mn), molybdenum (Mo), sodium (Na), and zinc (Zn)**.
- Six of these (boron, copper, iron, manganese, molybdenum, sodium, and zinc) are supplied to plants as **fertilizers**.
- Chlorine is not added to fertilizers since plants obtain sufficient quantities of chlorine from **the medium or from water**.

What is Plant Nutrition?



What is Plant Nutrition?

A little phrase can be used to help memorize the 16 essential elements for plant growth.

- It is *“C. B. Hops Café Mighty Good, Closed Monday, See You Zen.”*
- It represents the following: Carbon (**C**), Boron (**B**), Hydrogen (**Hops**), Oxygen (**HO**pkins), Phosphorus (**HoP**kins), Potassium (**HopK**ins), Nitrogen (**HopkiN**s), Sulfur (**HopkinS**), Calcium (**Café**), Iron (**café**), Magnesium (**Mighty g**ood), Chlorine (**C**losed), Manganese (**M**onday), Molybdenum (**M**orning), Copper (See you = **Cu**), Zinc (**Z**en).

What is Plant Nutrition?

- Other elements play important roles in plant growth and development.
- For instance, silicon (Si) improves **plant strength and disease resistance**.
- Nickel (Ni) is another element considered important for **plant growth**.



What is Plant Nutrition?

- Plants receive most of the nutrients they need from the **growing media**.
- In order to maintain healthy plants, a grower must provide the right type and amount of nutrients to the media so the plants can **absorb the nutrients and grow**.
 - 1. A **water test** can be performed to determine which nutrients are present and which nutrients are deficient or lacking. (Armstrong City Water)
 - 2. When nutrients are deficient in the water, the plant growth is **adversely affected**.

What is Plant Nutrition?

- It is common for plant leaves to show symptoms of a **nutrient deficiency** by turning colors.
- When **nitrogen** is deficient in the soil, a plant's older leaves turn **yellow**.
- Abnormal yellowing of plant leaves is a condition called **chlorosis**.
- A plant will show **purpling** in the stem or leaf when **phosphorus** is deficient.

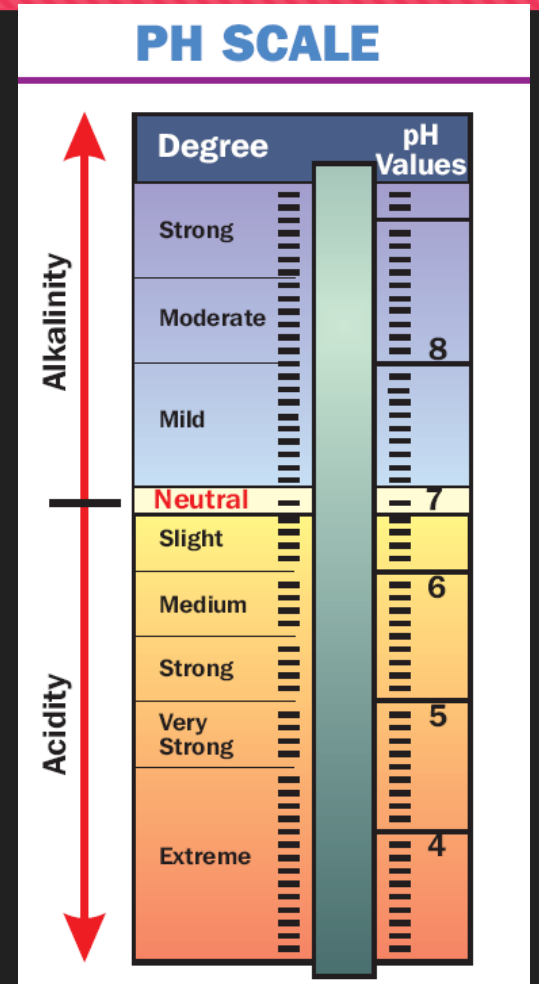


What is pH and how is it modified?

- Many times, the nutrients needed for plant growth are **present** in our water reservoir, but the plants **do not have access** to the nutrients.
- Nutrient availability is influenced by the **pH** in your nutrient water.
- **pH** measures the amount of acidity or alkalinity and is based on the amount of **hydrogen ions** present in the water.

What is pH and how is it modified?

- Soil pH can range from 1 to 14.
- A pH reading of 7 is neutral.
- Substances that have pH readings below 7 are acidic.
- Substances with pH readings above 7 are alkaline or basic.



What is pH and how is it modified?

- Plants have **specific pH ranges** that are ideal for maximum plant growth.
- Most plants grow best at a pH of **5.8 to 6.4** because the most nutrients are available for the plant to absorb in that range.
- Some important horticultural plants (azaleas) do better in a medium that has a more acidic pH.



What is pH and how is it modified?

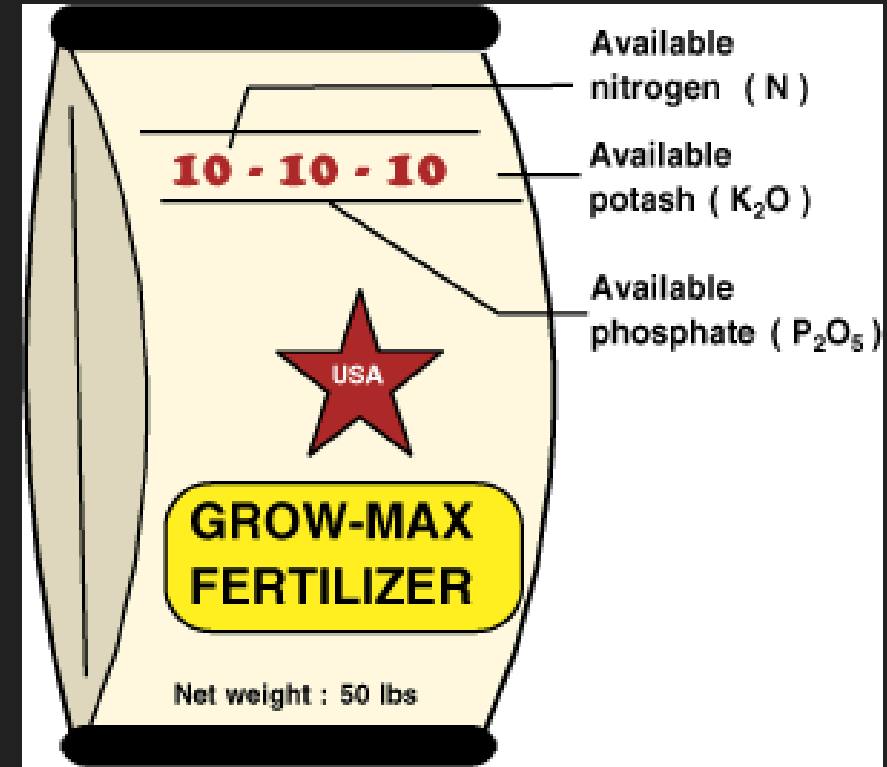
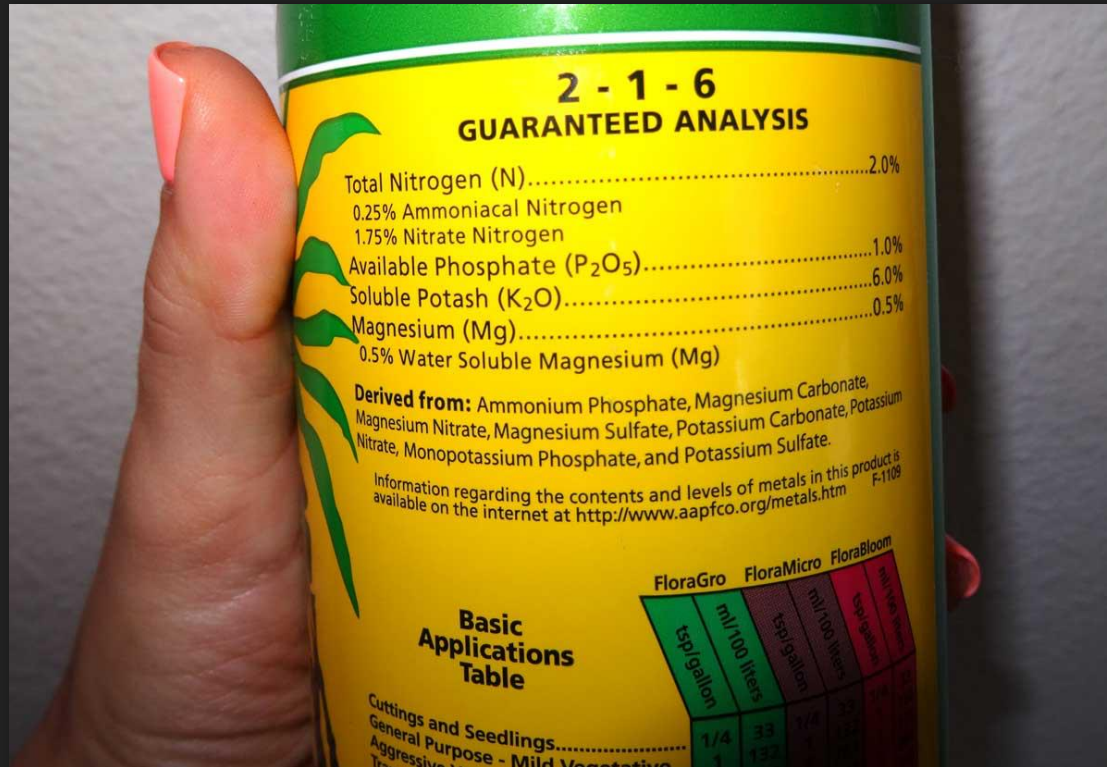
- A pH test can be performed to determine the pH of the water, and amendments (pH up or pH down) can be added to modify the pH.
- **Limestone** is commonly added to water in order to **raise** the pH.
- **Sulfur** or sulfur compounds can be added to the water to **lower** the pH.
- In our class we just use **pH down**.



Nutrients

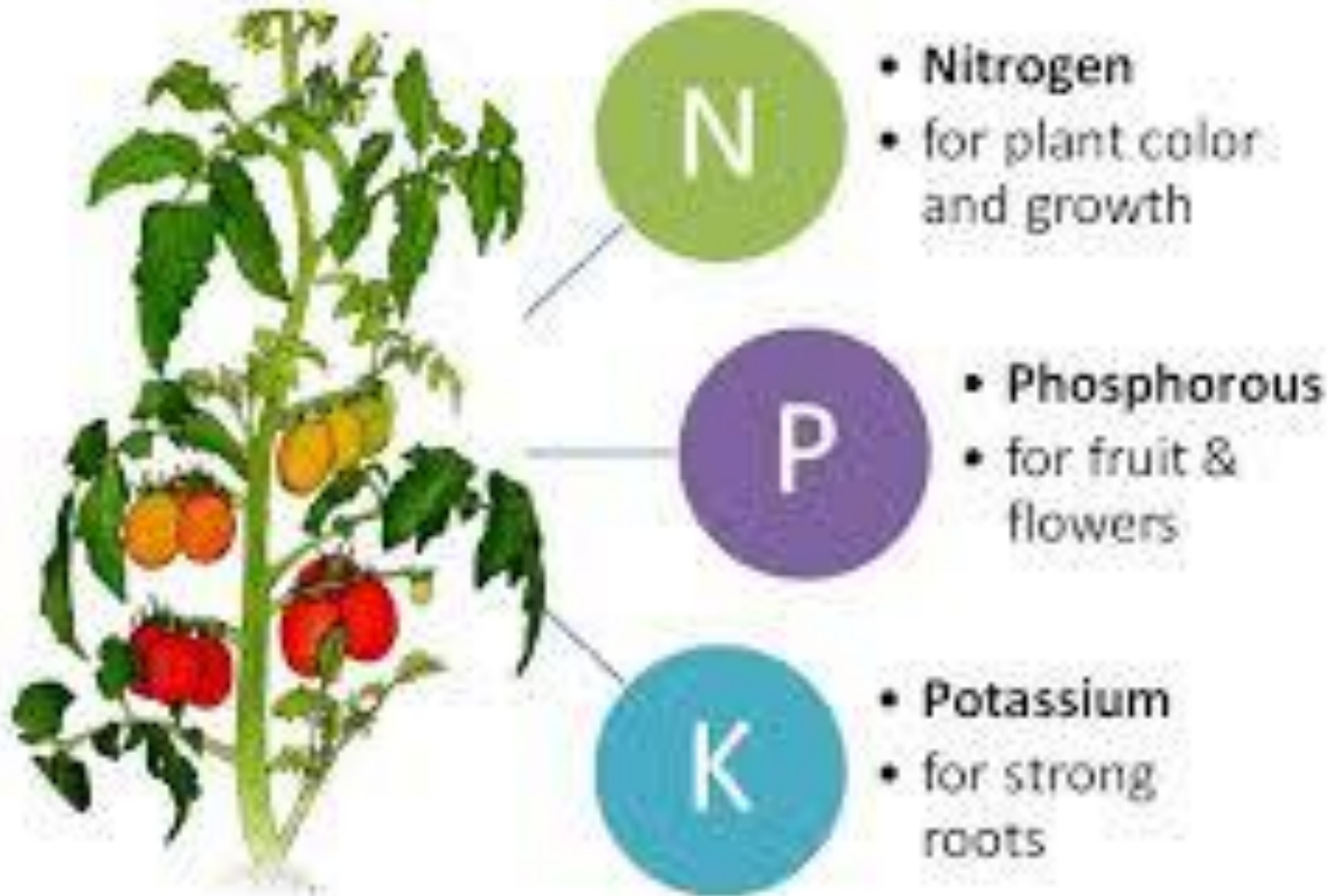
- When choosing Nutrients to add in your system, look for the **fertilizer analysis** on the container.
- The **Nutrient analysis** states the percentage of primary nutrients (**nitrogen, phosphate, and potash**) present.
- The analysis is written as **three numbers** (i.e., 15-10-26), which represent the **percent** of nitrogen, phosphorus, and potash present in the nutrient solution.
- **They are always listed in that order.**

Nutrients



Nutrients

Understanding Fertilizer Numbers



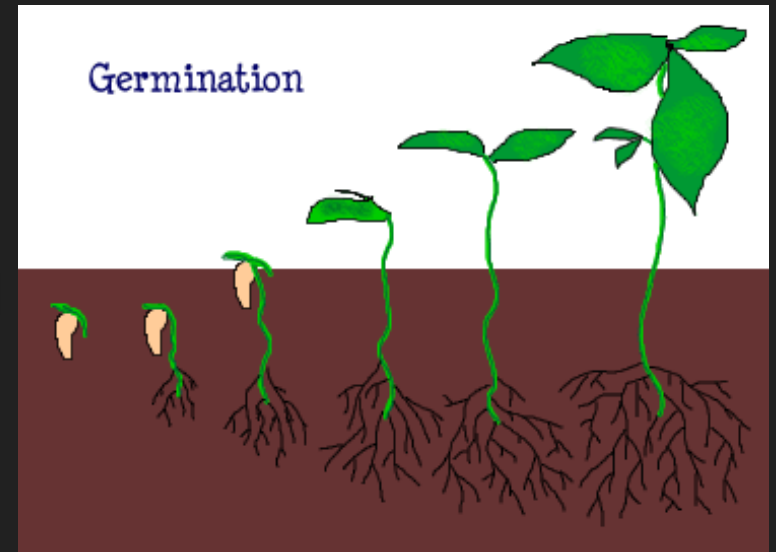
Fertilizer

- If a fertilizer contains all three primary nutrients, it is called a **complete fertilizer**.
- If a fertilizer is lacking any of the three primary nutrients, it is an **incomplete fertilizer**.
 - The fertilizer analysis **does not equal 100%**.
 - The rest of the fertilizer composition consists of **filler materials** (necessary for the fertilizer to be applied) and possibly some **micronutrients**.

Fertilizers

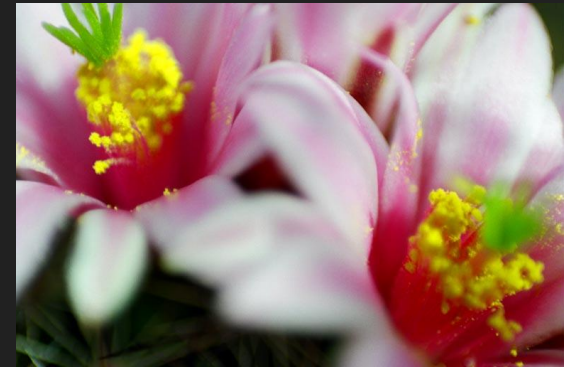
Plants have different nutrient requirements based on the **stage of growth**.

- The first stage is when the plant is a young **seedling or cutting**.
- In the second stage, **vegetative or leafy growth** is encouraged.



Fertilizers

- This is followed by the flower bud initiation stage, the flower bud development stage, and the flowering stages.
- Each stage calls for different rates of fertilizers.
- In the vegetative stage, plants use more nitrogen, whereas the flowering stage requires less nitrogen and more phosphorus.



Fertilizers

○ Fertilizers are typically applied as **water-soluble** fertilizer or as **slow-release** fertilizers.

1. **Water-soluble fertilizers** **dissolve completely in water and stay in solution.**

○ The concentrations of the water-soluble fertilizers are also **easily adjusted.**

○ The fertilizer concentrate is then mixed with the water in **exact proportions.**

Fertilizers

- All the plants of a particular crop receive the **same levels** of nutrients, which assists in producing a **uniform crop**.
- In addition, adjustments to the **level of nutrients** in solution can be **made easily**.



Fertilizers

- Nutrients in solution are measured in **parts per million or PPM**.
- Fertilizer rates can be taken from **tables in reference books** or to **instructions** with their injector system, or growers can calculate the amount of fertilizer needed to reach a desired PPM.
- In either case, it is beneficial for a grower to understand how to calculate parts per million (PPM) of fertilizer nutrients.