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Fertilizer
It's Not Just A Bunch of Bull

Who am I

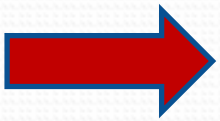
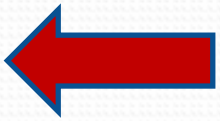
- A C.R. since 1995
- Master Rosarian since 2005
- Current CR Chair Pacific Southwest District
- Horticulture Judge
- 7 Term Past-President of Orange County Rose Society
- Current Rose Show Chair OCRS
- Worked in computer industry for 47 years
- Last 35 in software development
- Retired in 2006

Fertilizer Presentation Key

Since this presentation is part of a CR School it is focused on the contents of the current CR Manual

So:

If you will be sitting for the CR Exam and you see the following:

 OR 

You may want to wake up and make a note!

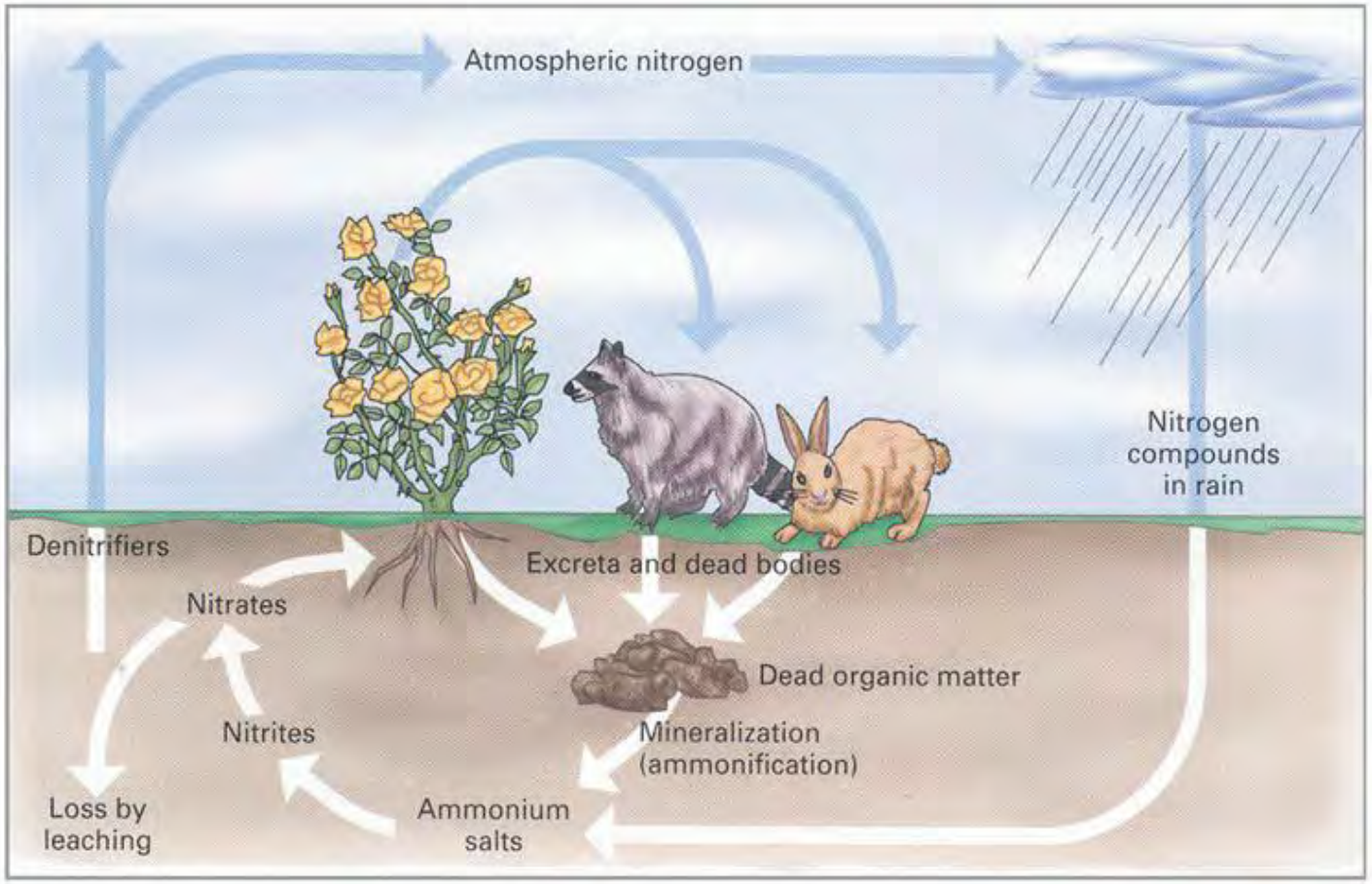
What is Fertilizer

Any of a large number of natural and synthetic materials, including manure and compounds containing nitrogen, phosphorus, and potassium, spread on or worked into soil to increase its capacity to support plant growth.

The American Heritage® Science Dictionary

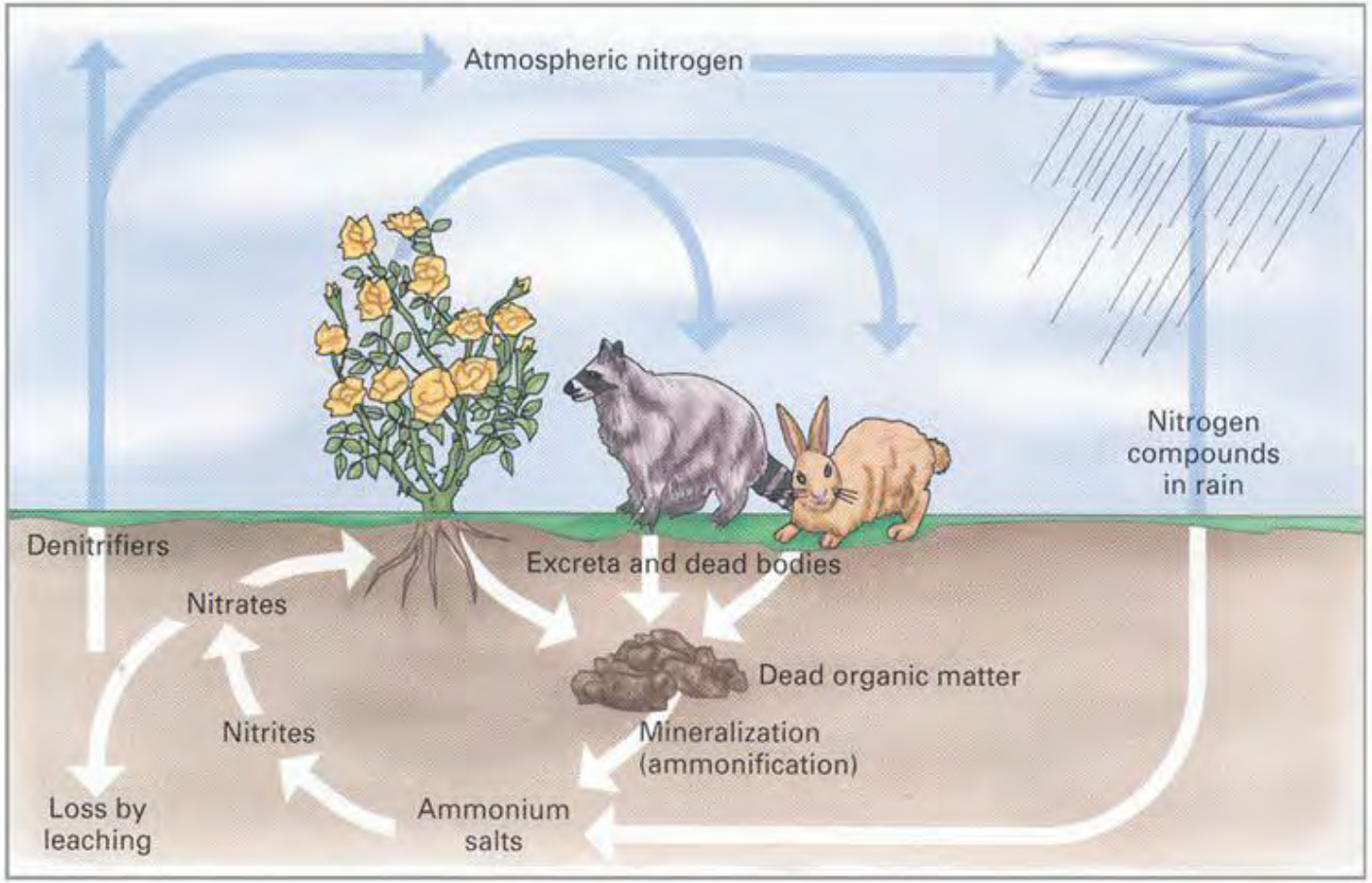
Plant Metabolism - Photosynthesis

Carbon dioxide + Water + Energy ! Sugar + Oxygen



Plant Metabolism - Respiration

Sugar + Oxygen ! Carbon dioxide + Water + Energy



Plant Elements

Nutrients

As much as 95% of a plant is made of carbon, hydrogen and oxygen. These nutrients are obtained from the air (from carbon dioxide (CO_2), and from water.

Remaining nutrients are obtained from the soil.

Element Components of a Typical Plant

Oxygen	45%
Carbon	44%
Hydrogen	6%
Nitrogen (N)	2%
Potassium (K)	1%
Calcium (Ca)	.6%
Phosphorus (P)	.5%
Sulfur (S)	.4%
Magnesium (Mg)	.3%

Macronutrients

The micronutrients make up the rest – only a very small amount,

This represents 99.8% of the components

Types of Fertilizers

- **Chemical Fertilizers** = synthetically produced. All chemical fertilizers are salts. All salts interfere with the ability of the plant to obtain water. Heavy applications of chemical fertilizers will cause burn on the leaves similar to not watering a plant during hot weather.
- **Organic Fertilizers** = come from once living organisms, low in nutrient content and are slow release requiring biological action from the soil organisms to release the nutrients. This feeds the soil life keeping the soil healthy (able to hold air, nutrients and water)…ex: manures, fish emulsion, alfalfa meal, cottonseed meal.
- **NEVER APPLY FERTILIZER TO DRY SOIL.** Roses should always be watered before and after an application of chemical fertilizer. The existing salt level in the soil can also contribute to the burning effects of adding chemical fertilizers.

- **Plants use nutrients in their ionic forms, so it does not matter from what source the nutrient originated.**

All fertilizers list the NPK ratio!

Represents the %, by weight, of each element

N-Nitrogen

P - Phosphorus

K - Potassium

N - Nitrogen

- Fuels growth of plant
- Gives plant tall, strong canes
- Healthy plant has rich, dark green foliage
- Lacking? – foliage is very light green to almost yellow.
- Too much? - not good either – you can “burn” a plant, weak canes, small blooms.

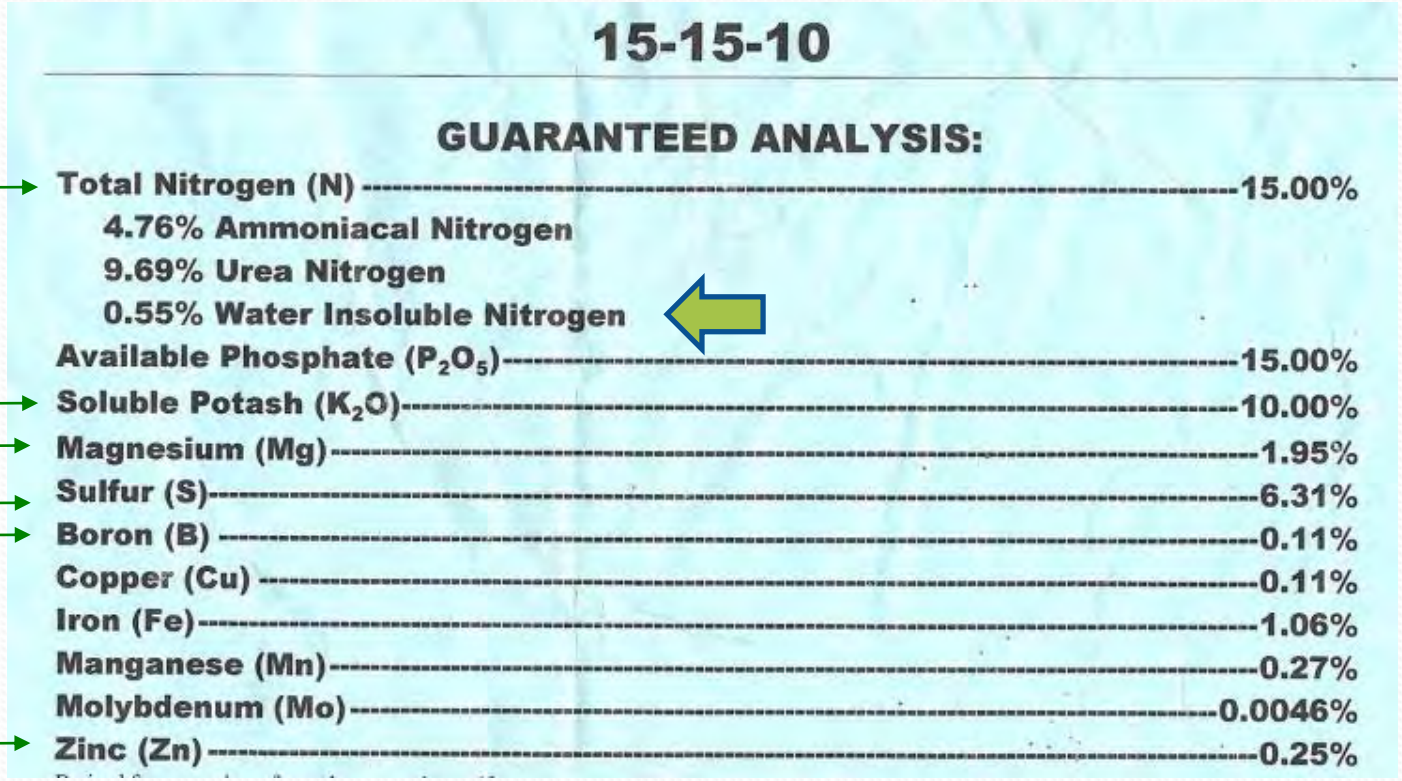
P - Phosphorus

- Stimulates root growth –
  - Helps produce a quality plant with big blooms
- May hasten plant maturity, and aid in winter hardiness
- Can get "locked up" in very acidic soils
  - Moves slow – about an inch per year
  - Newly planted roses need it at roots – many rosarians add super phosphate (0-45-0)

K - Potassium

- Promotes all around growth, vigor and bloom color
- Essential in development of chlorophyll by encouraging photosynthesis
- Aids in moving nutrients thru the plant
- Moves very quickly thru the soil – need to replenish on regular basis

Fertilizer Bag Label



The Big 3 NPK

Secondary Nutrients

Micro nutrients

Secondary Macronutrients

- Ca - Calcium - holds cell walls together, makes a sturdier plant
- Mg -Magnesium – very essential part of chlorophyll production for greener, healthy plants. Helps regulate uptake of nutrients
- S - Sulfur - used in development of proteins needed for plant health. Also lowers pH

Minor Micronutrients

- Often referred to as 'trace' elements
- Only small amounts are needed in the diet of a rose, but …..
- A lack of one or more may cause a serious decrease in availability of major elements

The Micronutrients

- Fe – Iron
  - Aids in chlorophyll formation and sugar burning enzymes
- Mn – Manganese
  - Aids chlorophyll formation
  - Helps in photosynthesis
- Zn – Zinc
  - Stimulates stem growth and flower formation

The Micronutrients (cont.)

- B – ***Boron***
  - ***Controls starch formation***
  - ***Stimulates cell division and flower formation***
- Cu – Copper
  - Stimulates stem development
- Mo – Molybdenum
  - Needed to make amino acid to stimulate plant growth and vigor

Basic Forms of Fertilizer

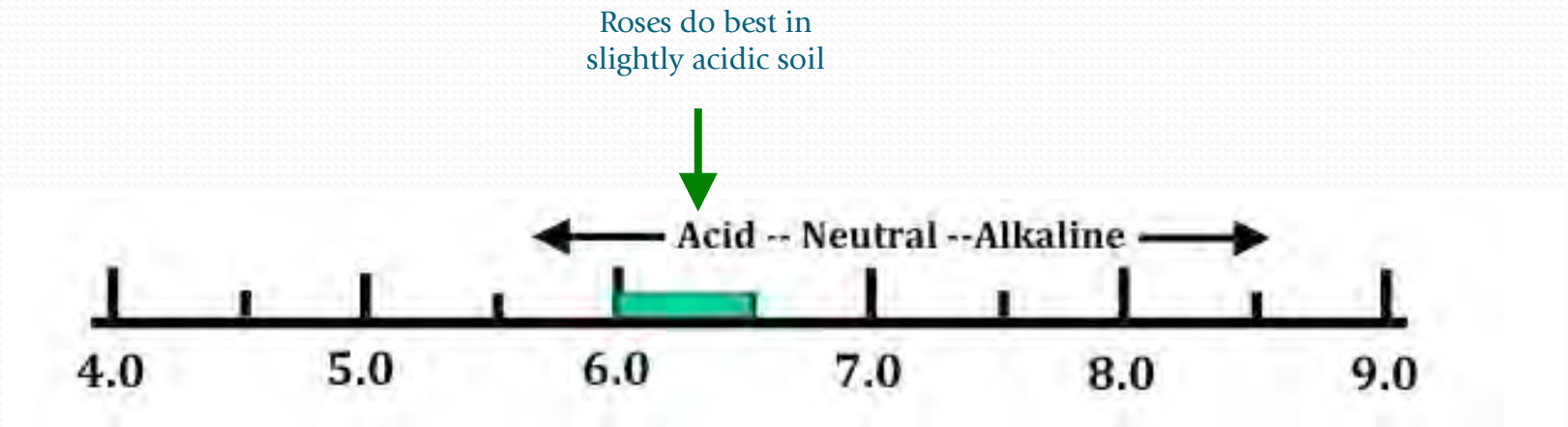
- Granular – designed to be scratched into soil, may also be water soluble
- Powdered – designed to be dissolved in water for liquid feeding to soil or foliage
- Liquid – usually a concentrated form to be mixed with water
- Solid – usually ‘spikes’ to push into soil around plant, very slow to dissolve

Common Natural Fertilizers and their nutritive value

Materials	N	P	K	Available	Comments
Dried Blood	12	0	0	high	
Bone Meal (steamed)	0	9	0	medium	
Rock Phosphate	0	13	0	low	must be ground to 200 mesh powder
Fish Emulsion	4	0.1	0	high	may attract pests
Fish Meal	10	4	0	high	may attract pests
Leaf Mold	1	0.4	1	medium	
Seaweed	1.5	0.7	5	medium	
Cottonseed Meal	7	2.5	2	high	may contain pesticide residues
Wood Ashes	0	2	5	high	hardwood preferred, liming effect.
Garden Compost	1	0.3	1	medium	varies with ingredients
Cow Manure	0.5	0.2	0.5	medium	rotted not dehydrated
Horse Manure	0.7	0.5	0.6	medium	rotted not dehydrated
Rabbit Manure	4	3	1	medium	rotted not dehydrated
Hen Manure	1.8	1	0.5	medium	rotted not dehydrated
Hog Manure	0.3	0.3	0.4	medium	rotted not dehydrated
Sheep Manure	1	0.35	0.5	medium	rotted not dehydrated
Sludge	4	2.5	0	medium	may contain toxic metals
Granite Dust	0	0	6		virtually insoluble
Limestone	-	-	-		used to raise pH
Dolomite Limestone	-	-	-		corrects magnesium deficiency and raises pH
Peat Moss	-	-	-		improves soil structure

*Human, cat and dog feces should not be used due to the danger of disease.

Soil pH - Definition



pH is a measure of the acidity or alkalinity

This is a logarithmic scale based on the "powers of ten"

A pH 5.0 is 10 times more acidic than a pH of 6.0

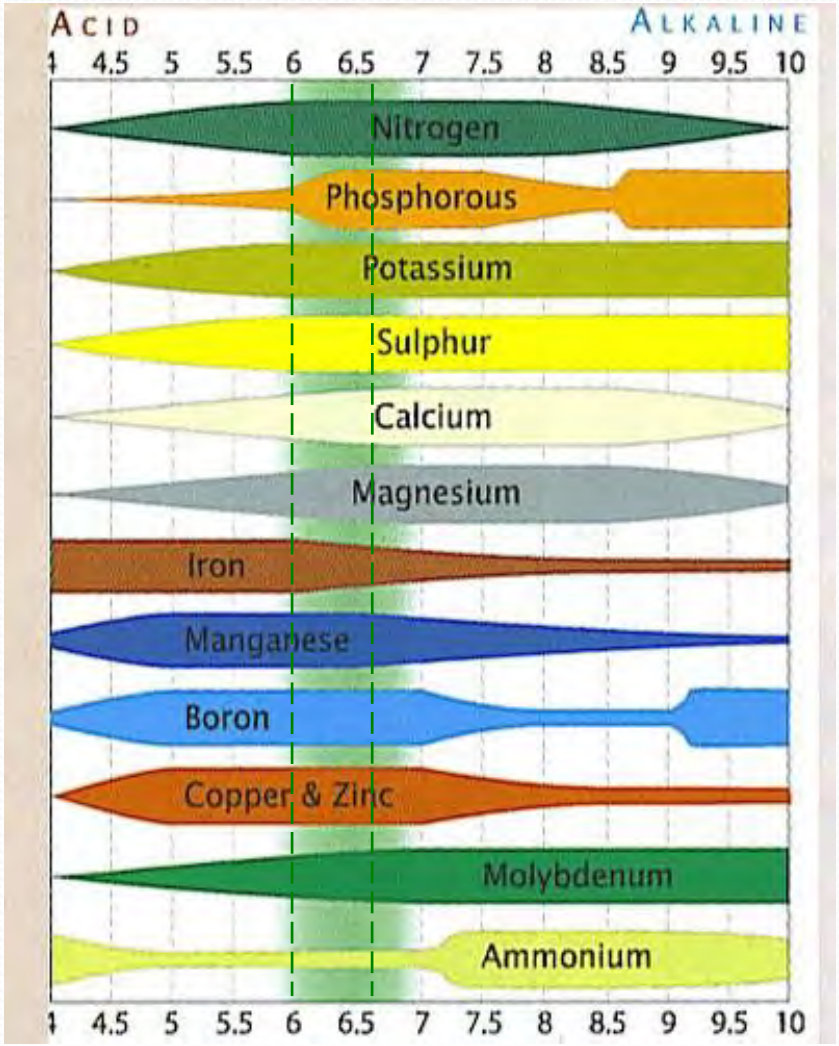
And a pH of 5.0 is 100 times more acidic than a pH of 7.0

Almost all fertilizers (both chemical and organic) tend to make the soil more acidic!

Soil pH and Roses

- A pH of 7 is neutral, below is acidic, above is alkaline
- Roses will tolerate a wide pH range from 5.5 to 7.8
- Test and adjust the pH if needed, as…..
- ***Roses do best in a slightly acidic soil – a pH of 6.0 – 6.5***

Nutrient Availability vs. Soil pH



Graph used with permission from Hobart Kitchen Gardens

How To Keep pH Correct

If soil is acidic

- Add lime to increase pH
- But it takes time to change the pH - do it in winter!
- Use soil test to determine level of magnesium for type of limestone to add

  -If sufficient, use calcitic

  - If low, use dolomitic

- Add compost, peat or organics to slightly lower pH
- A slow and usually continuous process
- Add sulfur for a quicker lowering

If soil is alkaline

Types of Fertilizers

Fertilizers are broadly divided into:

Organic

- Includes those which come from once-living organisms. All organic fertilizers tend to:
  - Be very low in nutrient content
  - Be a slow release form, needing warm soil activate
  - Have high levels of carbon
  - Slowly adds to level of humus in soil

Chemical (Inorganic)

- Can be in granular, liquid, powdered or solid form, are composed of synthetic chemicals and/or minerals:
  - In general, all chemical fertilizers are salts, which can interfere with water availability to the roots, if too much builds up in the soil
- Elements are quick acting and readily available

Plants can't tell the difference between inorganic and organic!

Types of Fertilizers

FERTILIZER CHARACTERISTICS

SOLUBLE INORGANIC	NATURAL ORGANIC	UREA-FORM
Immediately Available	Readily Available	Slowly Available
Lasts 3-4 weeks	Lasts 4-6 weeks	Lasts 20-24 weeks
Burns Foliage	Does not burn	Does not burn
Leaches from soil	Leaches from soil	Does not leach
No carry-over	Little carry-over	Significant carry-over to next season
No Odor	Odor might be offensive	No odor
High nutrient content	Low nutrient content	High nutrient content
High efficiency	Low efficiency	High efficiency
Concentrated	Bulky	Concentrated

Commonly Used Organic Materials

- **Cottonseed Meal** – good for use in high pH soil, as acidic action tends to lower pH while providing nutrients
- **Blood Meal** – rich in nitrogen, it may do harm if used in excess. Also supplies some essential trace elements, including iron
- **Bone meal** - slow acting release of phosphorus
- **Alfalfa Meal** – contains trianconatol, a natural growth stimulant, can be mixed in the soil or used as a tea
- **Compost** - boosts the level of organic matter and the overall fertility of the soil

A Few More Common Organics

- **Fish emulsion** – a good source of nitrogen and several trace elements. A strong solution CAN burn plants, particularly in containers
- **Mushroom compost** – a good slow-release fertilizer when mixed into soil, or as a mulch. It has an NPK ratio of 2-1-1 and a pH of 6.8
- **Seaweed or kelp extracts** – good source of trace elements
- **Manure** – a complete fertilizer, but low in amounts it can supply -best aged as fresh manure can burn tender roots, and can also harbor bacteria harmful to humans
- **Treated sewage biosolids** – general purpose, long lasting, non-burning, but may contain heavy metals that can be toxic in the soil

Another Type of Fertilizer

- **Slow release** –
- Releases nutrients over a period of time, from immediate up to 9 months
- Works in conjunction with processes in the soil
- Can be activated by temperature, moisture, bacterial activity in the soil, or pH depending on the type of coating used
- **Major advantage** – reduce chances of fertilizer burn
- **Cautions** –
  - Timing - plant growth may go late in fall
  - Too much water - nutrients released too fast

Slow Release vs Conventional

FERTILIZATION

Comparison of Slow-Release Fertilizers and Conventional Fertilizers

SLOW RELEASE FERTILIZER

Advantages	Disadvantages
1. Fewer applications	1. Unit cost is high
2. Low burn potential	2. Availability limited
3. Release rates vary depending on fertilizer characteristics	3. Release rate governed by factors other than plant needs
4. Comparatively slow release rate	

CONVENTIONAL FERTILIZER

Advantages	Disadvantages
1. Fast acting	1. Greater burn potential
2. Some are acid-forming	2. Solidifies in the bag when wet
3. Low cost	3. Leaches readily

MANURES OR SEWER SLUDGE

Advantages	Disadvantages
1. Low burn potential	1. Salt could be a problem
2. Relatively slow release	2. Bulky, difficult to handle
3. Contains micronutrients	3. Odor
4. Conditions soil	4. Expensive per pound of actual nutrient
	5. Weed seeds a problem
	6. Heavy metals may be present in sewage sludge; (more frequent in sludge from large cities)

Forms of Nitrogen

- **Nitrate Nitrogen**
  - Most available and fastest acting - w/o any change in the soil
- **Ammoniacal**
  - Slightly available - must be changed in soil to nitrate form for plant uptake
- **Urea**
  - Slowest available – must undergo major soil action
- **Nitrite**
  - Rarely used – too expensive

Frequently Observed Nutrient Imbalances

The four most observed imbalances

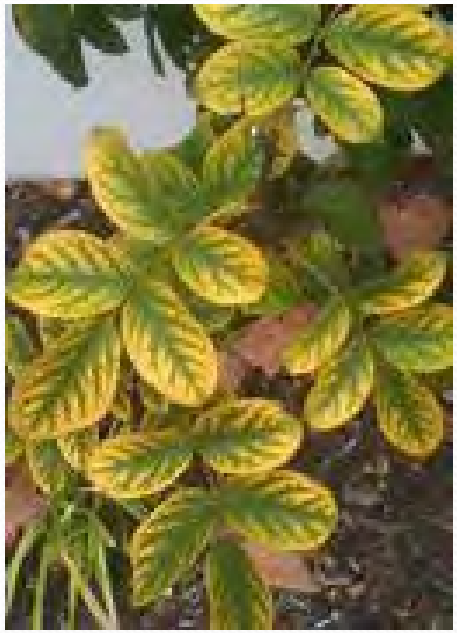
- **Nitrogen Deficiency**
  - Leaves show a pale yellow-green color, plant is stunted with smaller stems.

Frequently Observed Nutrient Imbalances

- **Oxygen Deficiency**
  - Symptoms similar to nitrogen deficiency, but adding nitrogen will not correct problem
  - Caused by a lack of air to the roots typically caused by over watering or poor drainage. **The veins of the leaf will show chlorosis (yellowing) followed by interveinal chlorosis.**

Nutrient Imbalances (cont.)

- **Iron Deficiency**
  - Opposite look of oxygen deficiency. Areas between veins shows yellowing, while veins remain green



Nutrient Imbalances (cont.)

- **Leaf Burn**
  - Edges turn brown from lack of water – over fertilizing, heat stress, spray burn, etc.

Heat Stress

Symptoms of Nutrient Deficiencies

- Many are problems of availability, not supply!
  - Soil test vs tissue sample
- Nutrients may be present in the soil, but are unavailable because of the pH range
- Generally, micronutrient deficiencies are rarely seen

Symptoms of Nutrient Deficiencies (cont.)

- **Affecting mature (older) leaves first**
  - Nitrogen, Magnesium, Phosphorus & Potassium
- **Affecting younger plant parts first**
  - Iron, Manganese, Boron, Copper, Calcium, Zinc & Molybdenum
- Where observed – older/new leaves? younger plant parts?
- Use available resources, e.g., CR manual, internet, etc., to identify the symptoms, confirm the diagnosis – then treat!

Symptoms of Nutrient Deficiencies (cont.)

- **Effects of Soil Salts**
  - In heavily fertilized roses, accumulation of soluble salts is not uncommon.
  - May interfere with water availability in the root zone.
  - The higher the salt contents of the soil, the greater the stress on the plant to obtain moisture from that soil.
  - roses growing in soils having high salt concentrations tend to induce a physiological drought in the plants. This effect intensifies as the moisture content of the soil decreases.

Symptoms of Nutrient Deficiencies (cont.)

- Many of the inorganic fertilizers commonly used on roses can produce a high salt index. However, when applied in suitable amounts the salt effect is usually not a problem. (don't overdo).
- It is important for the rose grower to appreciate the importance of water in the use of fertilizer material capable of inducing high salt effects.
- Small applications of water tend to dissolve the fertilizers and to develop the highest soluble salt concentration possible in the root area.
- Applications of water which cause some, but not too much, leaching tend to affect a loss of such materials as sulfates and chlorides, with little loss of ammonium or potassium, thus minimizing an increase of salts.
- Such watering gives good distribution of applied fertilizers. This is why one should never feed roses if the soil is dry and adequate watering should be done after fertilizing.

Some Do's and Don'ts

- **DO** Test your soil – If the pH is way out of the 6.0 – 6.5 range, important nutrients in the soil may be unavailable to the plant
- Soil must warm before using chemical fertilizers to activate the microorganisms that break it down, or it just leaches into the soil and can get into water sources
- Constant use of chemical fertilizers without adding organic material can deteriorate the soil structure and its overall health

Some Do's and Don'ts

- **DO** Feed often, but **don't overdo it** – every 4-6 weeks is adequate. Be conservative in what you add – more is NOT always better!
- **DO** Water deep before and after fertilizing – **a MUST**! Helps dilute so as not to burn, plus helps move nutrients to root zone.
- Before looking into plant diseases and deficiencies, see what the individual is using for pest control.

A Memory Aid

N-Nitrogen

P - Phosphorus

K – Potassium (Potash)

Remember the phrase
Up – Down – All Around

1st Number – Up
2nd Number – Down
3rd Number – All around

- Up: **Nitrogen promotes growth above the ground**
- Down: **Phosphorous promotes good, healthy roots**
- All around: **Potassium benefits the whole plant**

A Final Word to Remember

- Roses and Children have this in common:
  - Feed them a well-balanced diet and they will grow strong and healthy and reach their full potential.