



# Advanced Fertilizers Technologies

## Lecture I

# Definitions and terms of Fertilizers

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# FERTILIZER

Fertilizer is any substance, whether organic or inorganic, natural or synthetic, that provides plants with one or more of the essential nutrients major (nitrogen, phosphorous, potassium, calcium, magnesium, sulfur) and micro (copper, iron, boron, zinc, molybdenum). ) for the plant and contains at least 5% of it, which helps plant grow and improve its productivity



# MINERAL FERTILIZERS

They are industrially produced and contain different concentration of nutrients.

There are different types of mineral fertilizers , including **single straight**, they are contain only one nutrient such as **urea** (46% nitrogen) and **concentrated superphosphate** (20.21% phosphorous)

or two or more nutrients such as **NPK** fertilizer in different concentrations.



## Compound Fertilizers

They are fertilizers that contain **two or more nutrients**, such as **NPK** fertilizers, which contain different percentages of each or two of them. This term is used in Europe, not in America, and it is a fertilizer that contains two or more nutrients, which in America is equivalent to mixed or mixed fertilizer.

## Mixed Fertilizer

It is a mineral fertilizer that contains **two or more of nutrients (N, P, K)** for the plant. It can be mixed with other necessary nutrients to increase plant productivity and improve its growth.

In the United States of America, this fertilizer means fertilizer that contains two or more substances and mixed together. In some countries, it means compound fertilizers that are mixed by mechanical mixing without a chemical reaction.

## Complete Fertilizer

It is a fertilizer contain three main nutrients (N, P, K).



# FORMULA OR FORMULATION OF FERTILIZER

It is a list of materials showing the composition of materials and the percentage of nutrients in fertilizers, and the weight of the quantities required to produce a specific weight (for example, tons) of compound or single fertilizers

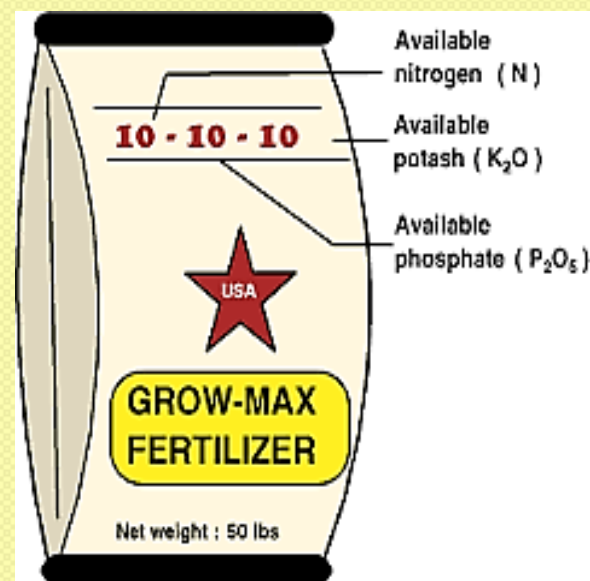
Common name	Chemical formula	N (%)	P <sub>2</sub> O <sub>5</sub> (%)	K <sub>2</sub> O (%)
Ammonium nitrate	NH <sub>4</sub> NO <sub>3</sub>	34	0	0
Ammonium sulphate	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	21	0	0
Ammonium nitrate-urea	NH <sub>4</sub> NO <sub>3</sub> + (NH <sub>2</sub> ) <sub>2</sub> CO	32	0	0
Anhydrous ammonia	NH <sub>3</sub>	82	0	0
Aqua ammonia	NH <sub>4</sub> OH	20	0	0
Urea	(NH <sub>2</sub> ) <sub>2</sub> CO	46	0	0
Superphosphate	Ca(H <sub>2</sub> PO <sub>4</sub> ) <sub>2</sub>	0	20-46	0
Monoammonium phosphate	NH <sub>4</sub> H <sub>2</sub> PO <sub>4</sub>	13	52	0
Diammonium phosphate	(NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub>	18	46	0
Urea-ammonium phosphate	(NH <sub>2</sub> ) <sub>2</sub> CO + (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub>	28	28	0
Potassium chloride	KCl	0	0	60
Monopotassium phosphate	KH <sub>2</sub> PO <sub>4</sub>	0	50	40
Potassium nitrate	KNO <sub>3</sub>	13	0	45
Potassium sulphate	K <sub>2</sub> SO <sub>4</sub>	0	0	50

Fertilizer	Amount	Fe	Mn	B	Cu	Mo	Zn
	<i>g.1,000 L<sup>-1</sup></i>	<i>mg.L<sup>-1</sup></i>					
Fe-EDTA (Fe)	28.60	30					
Manganese sulphate (Mn)	8.11		2				
Boric acid (B)	22.50			5			
Copper sulphate (Cu)	2.00				0.5		
Ammonium molybdate (Mo)	8.70					5.0	
NaZnEDTA (Zn)	2.00						0.5
<b>TOTAL</b>		<b>30</b>	<b>2</b>	<b>5</b>	<b>0.5</b>	<b>5.0</b>	<b>0.5</b>

# FERTILIZER GRADE

It is the amount of nutrients as a percentage in the compound fertilizer in the form of **total nitrogen**, **phosphorous oxide ( $P_2O_5$ )** and **potassium oxide ( $K_2O$ )** in different quantities.

For example, the compound fertilizer 20-20-5 indicates that the fertilizer contains **20% nitrogen**, **20%  $P_2O_5$**  and **5%  $K_2O$** . There are many examples of these fertilizers, such as the following fertilizer grades 34-12-0 and 18-0-12



# FERTILIZER RATIO

The ratio of total nitrogen to phosphorous oxide ( $P_2O_5$ ) to potassium oxide ( $K_2O$ ) in the compound or complete fertilizer.

**Examples:**

**20-20-20**

The ratio of the fertilizer is 1:1:1

**15-30-15**

The ratio of fertilizer is 1:2:1

**10-5-5**

The ratio of fertilizer is 1:1:2

## • Fertilizer Ratio

-20-5-10 = 4-1-2 ratio

-30-10-10 = 3-1-1 ratio

-10-5-20 = 2-1-4 ratio

# FERTILIZER FILLER

They are materials that are added to manufactured fertilizers to keep them from drying out, agglomerating and hardening, such as **sand, clay, granular stone and other cheap materials** that are not harmful to plants or the environment.

For example, the compound fertilizer 20-10-12 contains 20% total nitrogen, 10% phosphorous oxide, and 12% potassium oxide, portion is the and the remaining fertilizer filling .

Table 1. Combinations of treatments with source K and percentage filter cake

Variable	Source of K <sub>2</sub> O	Filler	
		% Filter cake	% Clay
K1B0	KCl	0	100
K1B1	KCl	60	40
K1B2	KCl	70	30
K1B3	KCl	80	20
K1B4	KCl	90	10
K1B5	KCl	100	0
K2B0	K <sub>2</sub> SO <sub>4</sub>	0	100
K2B1	K <sub>2</sub> SO <sub>4</sub>	60	40
K2B2	K <sub>2</sub> SO <sub>4</sub>	70	30
K2B3	K <sub>2</sub> SO <sub>4</sub>	80	20
K2B4	K <sub>2</sub> SO <sub>4</sub>	90	10
K2B5	K <sub>2</sub> SO <sub>4</sub>	100	0



## Granular Fertilizers

They are manufactured fertilizers in the form of granules or particles, whose dimensions are between **1-4 mm**. The size of the granule can be controlled industrially, either by sticking it if the granules are disassembled and sieved industrially according to the required sizes.



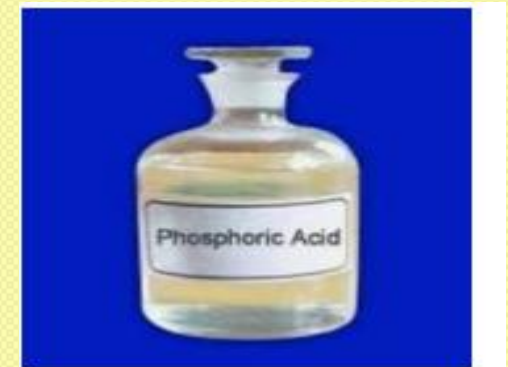
## Non Granular Fertilizers

It is a fertilizer containing fine and very fine particles with coarse particles whose dimensions do not exceed **3 mm**.



# INTERMEDIATE FERTILIZERS

They are fertilizers that can be used directly, such as **ammonia**, **phosphoric acid** and **sulfuric acid**, and at the same time they are used as **raw materials for the manufacture of other fertilizers**. Like **ammonia**, **urea** fertilizer can be made from it, and **phosphoric acid** is made from it with **phosphate rock**, concentrated superphosphate, and sulfuric acid with phosphate rock in the manufacture of ordinary superphosphate fertilizer.



Rock Phosphate, Rock Phosphate Po...



## Conditioned Fertilizers

They are fertilizers that are treated with additional materials in order to improve their **physical properties**, including the process of agglomeration, liquefaction and liberation of nutrients and other qualities.

## Coated Fertilizers

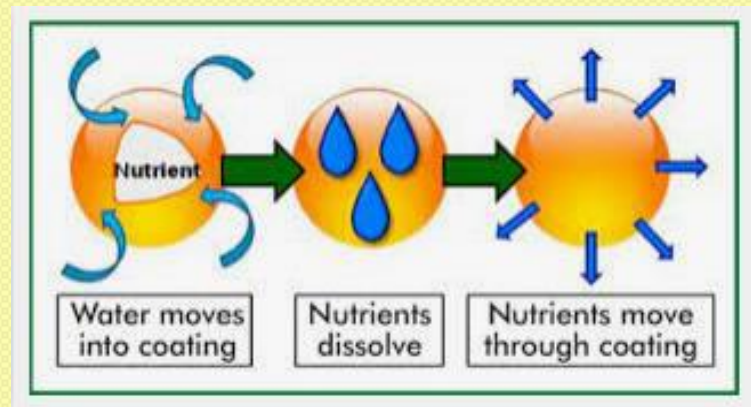
They are granular fertilizers that are covered or coated with a thin layer of another substance such as **sulfur coated urea, humic or fulvic acid, clay, polymers, organic materials** or other natural compounds and other materials to reduce dissolution and release nutrients. And reduce losses from adding fertilizer



China Sulfur Coated Urea - China Sulf...

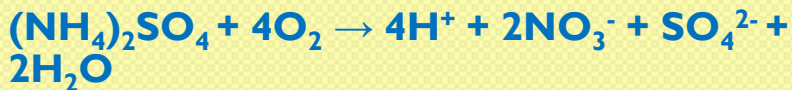


Humic acid urea.Stronger effects th...  
humicchina.com



## Acid Forming Fertilizers

They are fertilizers with an **acidic effect** in (soil, water), for example the nitrification of ammonium salts by soil bacteria. Ammonium sulfate fertilizer is a salt with neutral effect, but in the soil it is oxidized by **nitrosomonas** bacteria to nitrite ( $\text{NO}_2^-$ ) and then by **Nitrobacter** bacteria to nitrate ( $\text{NO}_3^-$ ). The net interaction is as follows:-



One mole of ammonium sulfate produces four moles of hydrogen, which reduce the pH value of soil .

## Basic(Alkaline) Fertilizers

They are fertilizers with alkaline effect in the soil . Usually, fertilizers containing ammonium tend to acidify the soil, while fertilizers containing nitrates tend to be basic. Such as **sodium nitrate, calcium nitrate and magnesium nitrate.**



## Suspension Fertilizers

It is a fertilizer that contains solid particles suspended in a liquid, and the solid particles may or may not be soluble in water.

## Liquid Fertilizers

They are fully or partially soluble fertilizers in solution and do not contain insoluble materials. Such as aqueous ammonia fertilizer.



## Organic Fertilizers

They are fertilizers derived from **human sources (sewage waste) or animal (such as animal waste, fish, etc., or vegetable (plant residues))** and nutrients are gradually released from them by the action of bioactivity .



## Green Manure

It is the fertilizer that is produced from growing plants for the purpose of adding them to the soil and preparing them with nutrients by turning them over and mixing them with the components of the soil and the plant is still green and before flowering and for a period of not less than 15 months from the next crop. Leguminous crops are often used, including jet, alfalfa, soybeans and beans, and there are non-legume crops that can be used as green fertilizers such as barley and sometimes wheat or millet, and the use of these fertilizers depends on soil fertility, crop

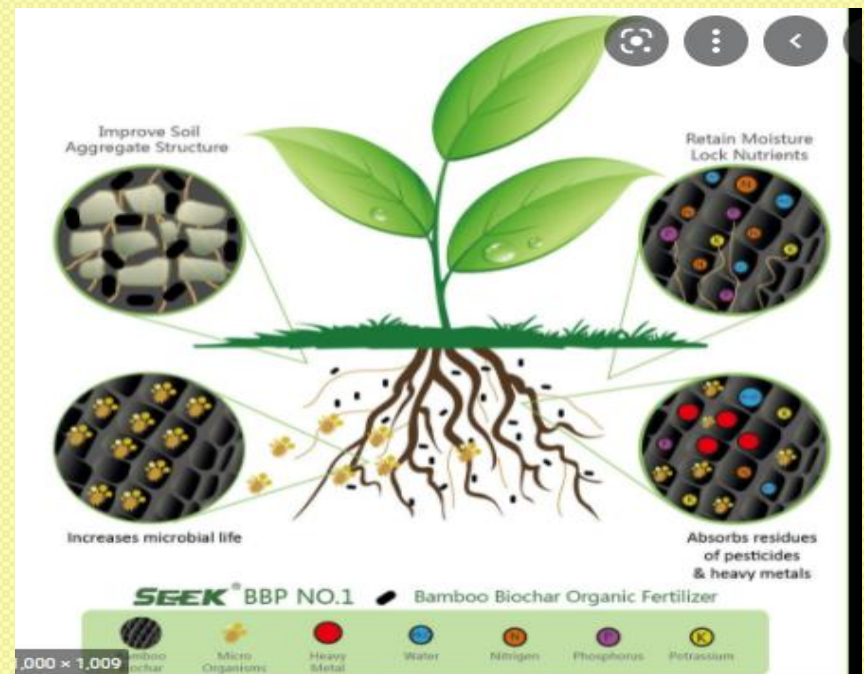


Green Manure: Types, Advantages and ...  
[conserve-energy-future.com](http://conserve-energy-future.com)

# BIOFERTILIZERS

They are any additives of biological origin (whether they are live microbes or their secretions) that supply the plant with its nutritional needs.

They are also called bio-fertilizers or microbial inoculants. They produce bio-fertilizers from microorganisms, whether they are **bacteria, algae, or fungi**, individually or in combination, that work to increase the availability of nutrients. soil and improve its properties.



A yellow sticky note is placed on a white wooden surface. The note has the text "ANY QUESTIONS?" written on it in purple and brown ink. The background is decorated with several green leaves of various shapes and sizes. A vertical yellow bar is on the left side of the image.

ANY  
QUESTIONS?