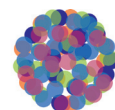


# F3 FERTILISERS

## THE FARMERS' WAY



**CHEMICAL  
INDUSTRIES**  
RESOURCE PACK

### Manure

Manure is organic matter used as organic fertiliser in agriculture. Manures contribute to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil. Manure is an excellent fertiliser containing nitrogen, phosphorus, potassium and other nutrients. It also adds organic matter to the soil which may improve soil structure, aeration, soil moisture-holding capacity, and water infiltration.

The nitrogen compounds in manure are eventually converted to the available nitrate form. Nitrate is soluble and is moved into the root zone with water. However, the release of available nitrogen from the complete organic compounds during manure decomposition is very gradual. This slow release of nitrogen is manure's most important asset. It extends nitrogen availability and reduces leaching, a problem especially in sandy soils.

The idea is to first apply enough manure to meet the first year's need of available nitrogen. Decreasing amounts are then applied in following years because of the carry-over organic nitrogen that will be released from previous applications. If the same rate of manure is applied each year, it is possible for a field originally low in nitrogen to accumulate unnecessarily high levels in successive years.



*This material was adapted from Wikipedia. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Wikipedia. 2010. Manure. [Online]. Available: <http://en.wikipedia.org/wiki/Manure> [1 July 2010].*

Green manures are crops grown for the express purpose of ploughing them under. In so doing, fertility is increased through the nutrients and organic matter that are returned to the soil. Leguminous crops, such as clover, also "fix" nitrogen through rhizobia bacteria in specialised nodes in the root structure. This further contributes to the fertility of the soil by feeding the fungi in the soil.

### Guano

Guano is the excrement (faeces and urine) of seabirds, bats, and seals. Guano manure is an effective fertiliser due to its high levels of phosphorus and nitrogen and also its lack of odour. Superphosphate made from guano is used for aerial topdressing. Soil that is deficient in organic matter can be made more productive by addition of this manure. Guano consists of ammonia, along with uric, phosphoric, oxalic, and carbonic acids, as well as some earth salts and impurities. Guano also has a high concentration of nitrates. Currently vast volumes of phosphorus are needed to produce fertiliser, as it is an essential plant macronutrient. Guano is rich in phosphorus and is an intensely effective phosphorus fertiliser. Guano was mined off the South African West Coast from as early as 1666 and provided the first farmers with fertilisers for their crops. The exploitation of guano started in the 1840's and by the turn of the century farmers had to find other ways to fertilise their fields.

### Crop rotation

Crop rotation avoids a decrease in soil fertility, as growing the same crop repeatedly in the same place eventually depletes the soil of various nutrients. A crop that depletes the soil of one kind of nutrient is followed during the next growing season by a different crop that returns that nutrient to the soil or draws a different ratio of nutrients, for example, rice followed by cotton. Rotating crops adds nutrients to the soil. Legumes have nodules on their roots which contain nitrogen-fixing bacteria. It therefore makes good sense agriculturally to alternate them with plants that require nitrates. A common modern crop rotation is alternating soybeans and maize (mealies). Crop rotation is a type of agricultural control that is also used to control pests and diseases that can become established in the soil over time. This principle is of particular use in organic farming, where pest control may be achieved without synthetic pesticides.

*This material was adapted from Wikipedia. Learners- if you use any part of it you need to write it in your own words and include the following in your reference list: Wikipedia. 2010. Crop rotation. [Online]. Available: [http://en.wikipedia.org/wiki/Crop\\_rotation](http://en.wikipedia.org/wiki/Crop_rotation) [1 July 2010].*

## The use of lime in farming

The addition of lime to acidic soil increases the pH value of the soil. The increase in pH level of the soil increases the solubility of nitrogen, potassium and phosphorous compounds, which will therefore be more readily available for absorption by plants. Limestone ammonium nitrate, or LAN, is often used as a fertiliser.

### Limestone



Source: [www.mil.org](http://www.mil.org)

## Chemical fertilisers

As far as can be ascertained, the first time chemical fertiliser was used in South Africa was in 1890. This was a small consignment of "corn and hay" fertiliser imported for a certain Van Heerden of Malmesbury.

### Did you know?

**Lime is a general term used for various forms of a basic chemical produced from calcium carbonate rocks such as limestone ( $\text{CaCO}_3$ ) and dolomite ( $\text{CaMg}(\text{CO}_3)_2$ ).**

**Quicklime is calcium oxide ( $\text{CaO}$ ) and is produced by heating limestone.**  
$$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$$

**The quicklime dissolves in water to form calcium hydroxide.**  
$$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$$

**Calcium hydroxide will dissociate as follows when dissolved in water:**  
$$\text{Ca}(\text{OH})_2 \rightarrow \text{Ca}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq})$$

Source: Wikipedia

## Plant nutrient deficiency symptoms

### **Nitrogen (N) deficiency**

Symptoms: Older leaves, generally at the bottom of the plant, will yellow. Remaining foliage is often light green. Stems may also yellow and may become spindly. Growth slows.

### **Phosphorus (P) deficiency**

Symptoms: Small leaves that may take on a reddish-purple tint. Leaf tips can look burnt and older leaves become almost black. Reduced fruit or seed production.

### **Potassium (K) deficiency**

Symptoms: Older leaves may look scorched around the edges and/or wilted. Interveinal chlorosis (yellowing between the leaf veins) develops.

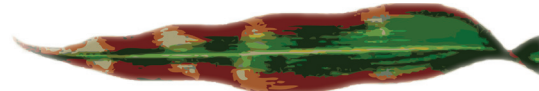
### **Sulfur (S) deficiency**

Symptoms: New growth turns pale yellow, older growth stays green. Stunts growth.

## Nutrient deficiency in maize plants



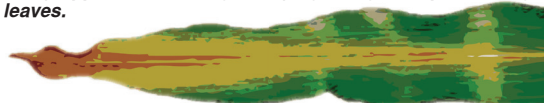
**HEALTHY** leaves with a rich dark green colour when adequately fed.



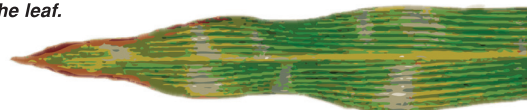
**PHOSPHATE** shortage marks leaves with reddish-purple, particularly on young plants.



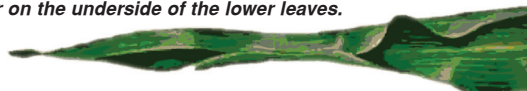
**POTASH** deficiency appears as a firing or drying along the tips and edges of the lowest leaves.



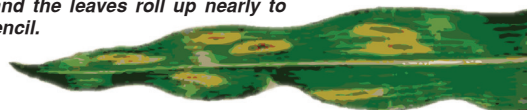
**NITROGEN** hunger sign is yellowing that starts at the tip and moves along the middle of the leaf.



**MAGNESIUM** deficiency causes whitish strips along the veins and often a purplish colour on the underside of the lower leaves.



**DROUGHT** causes the maize to have a greyish-green colour and the leaves roll up nearly to the size of a pencil.



**DISEASE**, helminthosporium blight, starts in small spots, gradually spreads across the leaf.



**CHEMICALS** may sometimes burn tips and edges of leaves. Tissue dies and leaf becomes whitecap.

Source: Queen's Printer for Ontario, 2010