

# ရေပျော်စာတ်မြေဩဇာများ (Water Soluble Fertilizers)



ဒေါက်တာခင်ခင်မူ  
မြေအသုံးချရေးဌာနခွဲ  
စိုက်ပျိုးရေးဦးစီးဌာန



# နိဒါန်း



♠ အပင်ကြီးထွားဖွံ့ဖြိုးရေး၊ မျိုးဆက်သစ်ပွားများရေး နှင့် အပင်အစိတ်အပိုင်းများ အဆင့်ဆင့် ပြောင်းလဲမှု လုပ်ငန်းစဉ်များအတွက် ပါဝင်နေသော ဓာတုဒြပ်စင်များနှင့် ဒြပ်ပေါင်းများကို တိုးချဲ့ သုံးစွဲလာသည် နှင့်အမျှ အပင်အာဟာရဓာတ် (Plant nutrition) ကိုလေ့လာရန် ပိုမို လိုအပ် လာပါသည်။

♠ အာဟာရဓာတ်ချို့တဲ့မှုဖြစ်လျှင် အပင်၏ဘဝစက်ဝန်းပုံမှန်လည်ပတ်မှု မရှိနိုင်၊ အချို့သော ဓာတုဒြပ်စင်များ မှာ အပင်အစိတ်အပိုင်းများတွက် မရှိမဖြစ်လိုအပ်ပြီး ဇီဝကမ္မ ဖြစ်စဉ်များတွင် အဓိကပါဝင်နေသည်။

♠ A fertilizer (American English) or fertiliser (British English) သည် မြေဆီလွှာ နှင့် အပင်တစ်ရှူး များအတွက် အပင်အာဟာရအဖြစ်အသုံးပြုသော သဘာဝပစ္စည်း မျိုးစုံ (သို့) လူတို့ ပြုပြင်ထုတ်လုပ်ထားသော မည်သည့်ပစ္စည်းကိုမဆို မြေဩဇာဟု ခေါ်ဆိုသည်။

♠ သဘာဝ မြေဩဇာနှင့် စက်ရုံထုတ်မြေဩဇာ(natural and industrially produced) နှစ်မျိုးလုံး သည် မြေဩဇာများပင်ဖြစ်သည်။

♠ ခေတ်မီ စိုက်ပျိုးရေး စနစ်များတွင် အဓိကအပင်အာဟာရဓာတ် three main macro nutrients: nitrogen, phosphorus, and potassium များဖြည့်ဆည်းပေးခြင်း၊ အခါအားလျော်စွာ အထောက်အကူပြုအနေနှင့်ထည့်သွင်းပေးသော အနည်းလိုအာဟာရဓာတ်များအားလုံးမှာ မြေဩဇာ ပင်ဖြစ်သည်။

# မြေဩဇာ အရည်နှင့် အခဲ (Liquid and solid)



- ♠ မြေဩဇာများကို အရည်အနေနှင့်ရော၊အခဲအခြေအနေနှင့်ပါ သီးနှံများအတွက်အသုံးပြုကြပါသည်။
- ♠ အသုံးပြုသောမြေဩဇာ၏ ၉၀ ရာခိုင်နှုန်းခန့်ကို အခဲအဖြစ်သုံးစွဲကြသည်။
- ♠ ယူရီးယား၊ ဒိုင်အမိုနီယမ် ဖော့စဖိတ် နှင့် ပိုတက်စီယမ် ကလိုရိုဒ် တို့ကို solid inorganic fertilizers အဖြစ်ကျယ်ပြန့်စွာ အသုံးပြုကြသည်။
- ♠ Solid fertilizer ပုံစံများအဖြစ် အစိုင်အခဲနှင့် အမှုန့် (granulated or powdered) အဖြစ်တွေ့ရှိနိုင်သည်။ တခါတရံ ဆေးခဲပုံစံ ([pills](#)) အခဲများကိုတွေ့ရှိနိုင်သည်။
- ♠ ရေမဲ့အမိုးနီးယား(Anhydrous ammonia)၊ ရေဖျော်အမိုးနီးယားအရည်( Aqueous solutions of ammonia)၊ ရေဖျော် အမိုနီယမ်နိုက်ထြိတ်/ ယူရီးယား(Aqueous solutions of ammonium nitrate or urea) များကို ရေဖျော်/ရေပျော် မြေဩဇာ အဖြစ်သုံးစွဲကြသည်။
- ♠ ပြင်းအားပြည့် မြေဩဇာအရည် (concentrated liquid fertilizer)ကို ရေဖြင့်ဖျော်၍ အသုံးပြုနိုင်။ e.g. [UAN](#) = UAN is a solution of urea and ammonium nitrate in water used as a fertilizer.
- ♠ ရေဖျော်/ရေပျော် မြေဩဇာများ သည် အကျိုးသက်ရောက်မှု လျင်မြန်ပြီးတုန့်ပြန်မှုကို အလွယ်တကူ တွေ့မြင်နိုင်သည်။

# မြေဩဇာ အသုံးပြုခြင်းမှာ သတိပြုရန် အချက် (၄)မျိုး ( Four risks of using fertilizer)



- ❑ အပင်ကြီးထွားဖွံ့ဖြိုးရေးနှင့် အထွက်နှုန်းမြင့်လာစေသည့် အကျိုးကျေးဇူးကြောင့် မြေဩဇာ ထည့်သွင်း အသုံးပြုမှု ခေတ်စားလာသည်။
- ❑ သို့သော် မြေဩဇာကို အလွန်အကျွံသုံးစွဲ ၍ အန္တရာယ်များကြုံတွေ့လာရသည်။
- ❑ မြေဩဇာကိုလိုအပ်သည်ထက်ပိုမိုထည့်ပေးခြင်းကြောင့်မြေဩဇာလောင်ကျွမ်းခြင်း “fertilizer burn” များကြုံတွေ့လာရသည်။
- ❑ မိမိမြေ၏ မြေဆီအာဟာရ လိုအပ်မှုကို မသိရှိပဲ မြေဩဇာကို ထည့်ခြင်း/သုံးစွဲခြင်းပြုလုပ်ကြ၍
  - ၁။ မြေဩဇာကို လိုအပ်ချက်ထက် လျော့ထည့်ခြင်း/ပိုထည့်ခြင်း (under- or over-fertilization) ခြင်းကြောင့် သင့်တင့်သော အထွက်နှုန်း မရရှိနိုင်ခြင်း
  - ၂။ မလိုအပ်ပဲ မြေဩဇာ ထည့်၍ ငွေကြေး အပိုကုန်ကျခြင်း
  - ၃။ အကန့်အသတ်ရှိသော သဘာဝအရင်းအမြစ် များကို အလဟဿဖြစ်စေခြင်း
  - ၄။ မြေဩဇာ အလွန်အကျွံ သုံးစွဲ၍ ပတ်ဝန်းကျင် ကိုထိခိုက်ပျက်စီးစေခြင်း

Alisa (2019) Farming, News



# ၁။ မြေဩဇာကိုလိုအပ်ချက်ထက်လျော့ထည့်ခြင်း/ပိုထည့်ခြင်းကြောင့် သင့်တင့်သော အထွက်နှုန်း မရရှိနိုင်ခြင်း



♣ စိုက်ပျိုးသီးနှံအတွက် မြေဩဇာအကြံပြုချက်မပေးမှီ မြေ၏အဆင့်အတန်း နှင့် အာဟာရဓာတ် လိုအပ်မှုကို မြေဆီလွှာ စမ်းသပ်စစ်ဆေးမှု ပြုလုပ်ပေးရမည်။

♣ မိမိလိုအပ်သည့် မြေဩဇာ ပမာဏ နှင့် အမျိုးအစားကိုသိရှိရမည်။ အကယ်၍ လိုအပ်သည့် မြေဩဇာ ကိုမသိပဲ ပမာဏကို လျော့သုံးခြင်း/ ပိုမိုထည့်ပေးခြင်း ပြုလုပ်ပေးမိပါက ရည်မှန်းအထွက်နှုန်းကို မရရှိနိုင်ပေ။

♣ မြေဩဇာကို လိုအပ်သည်ထက်ပိုမို ထည့်ခြင်း apply too much fertilizer (over-fertilization) ပြုလုပ်ခြင်း ၊ ထည့်သွင်းချိန် လွဲမှားခြင်း apply it at the wrong time တို့ကြောင့် “fertilizer burn” ဖြစ်တတ်ပြီး - အပင်မှာအပူလောင်ခြင်း (scorching of plant foliage) တွေ့ရမည်။ အထူးသဖြင့် နိုက်တြိုဂျင် ကိုလိုအပ်သည်ထက်ပိုထည့်မိခြင်းမျိုးမှာတွေ့ရတတ်။

# ၂။ မလိုအပ်ပဲ မြေဩဇာ ထည့်၍ ငွေကြေး



## အပိုကုန်ကျခြင်း

မြေထဲတွင် မှုရင်းရှိပြီးသား အာဟာရဓာတ်ကို ဆန်းစစ်မှုမရှိပဲ ထည့်ပေးပါက မြေထဲတွင်

ထိုအာဟာရ ဓာတ်တစ်မျိုးတည်းများပြားနေပြီး

ငွေကြေးအပိုကုန်ကျမှုသာဖြစ်စေသည်။

### *Excessive fertilizer*

- ❑ ဖန်လုံအိမ်ဓာတ်ငွေ့ထွက် (Release of harmful greenhouse gases into the atmosphere)
- ❑ ရေတွင် ဆားအနည်ကျမှုဖြစ်စေသည် (Eutrophication of waterways)
- ❑ ပတ်ဝန်းကျင်ညစ်ညမ်းစေခြင်း (Environmental pollution)
- ❑ မြေဆီ အရည်သွေးကျဆင်း (Decreased soil quality)
- ❑ မြေမှာ အချဉ်ဓာတ်တိုး (Increased soil acidity)
- ❑ အာဟာရဓာတ်များ စိမ့်စီးဆင်းစေ (Nutrient runoff)
- ❑ မြေအောက်ရေတွင် ညစ်ညမ်းစေ (Groundwater contamination)
- ❑ သဘာဝတွင်ရှိနေသော အာဟာရစက်ဝန်းပျက်စီးစေ (Disruption of natural nutrient cycles)

## ၃။ အကန့်အသတ်ရှိသော သဘာဝအရင်းအမြစ် များကို အလဟဿဖြစ်စေခြင်း



- ❖ Nutrients such as phosphorus and potassium present in inorganic fertilizers are limited resources.
- ❖ Phosphorus, for example, is mined from phosphate deposits that are unevenly distributed around the world.
- ❖ The term “peak phosphorus” is used to describe the point in time when we reach the maximum global production rate of phosphorus.
- ❖ According to researchers peak, phosphorus will be reached in approximately 2030, whereas phosphorus reserves are expected to be depleted within the next 100 years.
- ❖ Therefore, we need to be more efficient in our usage of phosphor-based fertilizers nowadays in order to prevent a shortage in the future.

# ၄။ မြေဩဇာ အလွန်အကျွံ သုံးစွဲ၍ ပတ်ဝန်းကျင် ကိုထိခိုက်ပျက်စီးစေခြင်း



- ♣ Soil testing provides a fertilizer recommendation and enables farmers to apply the right fertilizer and quantity that will be utilized by the plants.
- ♣ This minimizes the chances of applying excessive amounts of fertilizers and the resulting environmental damage.

For example, excessive nitrogen-rich fertilizers might runoff from the field into water bodies causing an excess of nutrients in the water and rapid growth of plant life – a process known as **eutrophication** – with detrimental effects for water

quality. **Eutrophication** ; is the process by which an entire body of water, or parts of it, becomes progressively enriched with minerals and nutrients, particularly nitrogen and phosphorus. It has also been defined as "nutrient-induced increase in phytoplankton productivity".




# Minimize Impact to the Environment:



- ♣ Adopting nutrient stewardship contributes to the preservation of natural ecosystems by growing more on less land.
- ♣ Retaining nutrients within a field's boundaries and in the crop rooting zone greatly reduces the amount that is not utilized by plants and thereby escapes into the environment as pollution.


THE 4 Rs of Nutrient Stewardship

A few examples of 4R practices that help keep nutrients in the root zone when crop needs them.




**RIGHT SOURCE**

Matches fertilizer type to crop needs.




**RIGHT TIME**

Makes nutrients available when crops need them.



**RIGHT RATE**

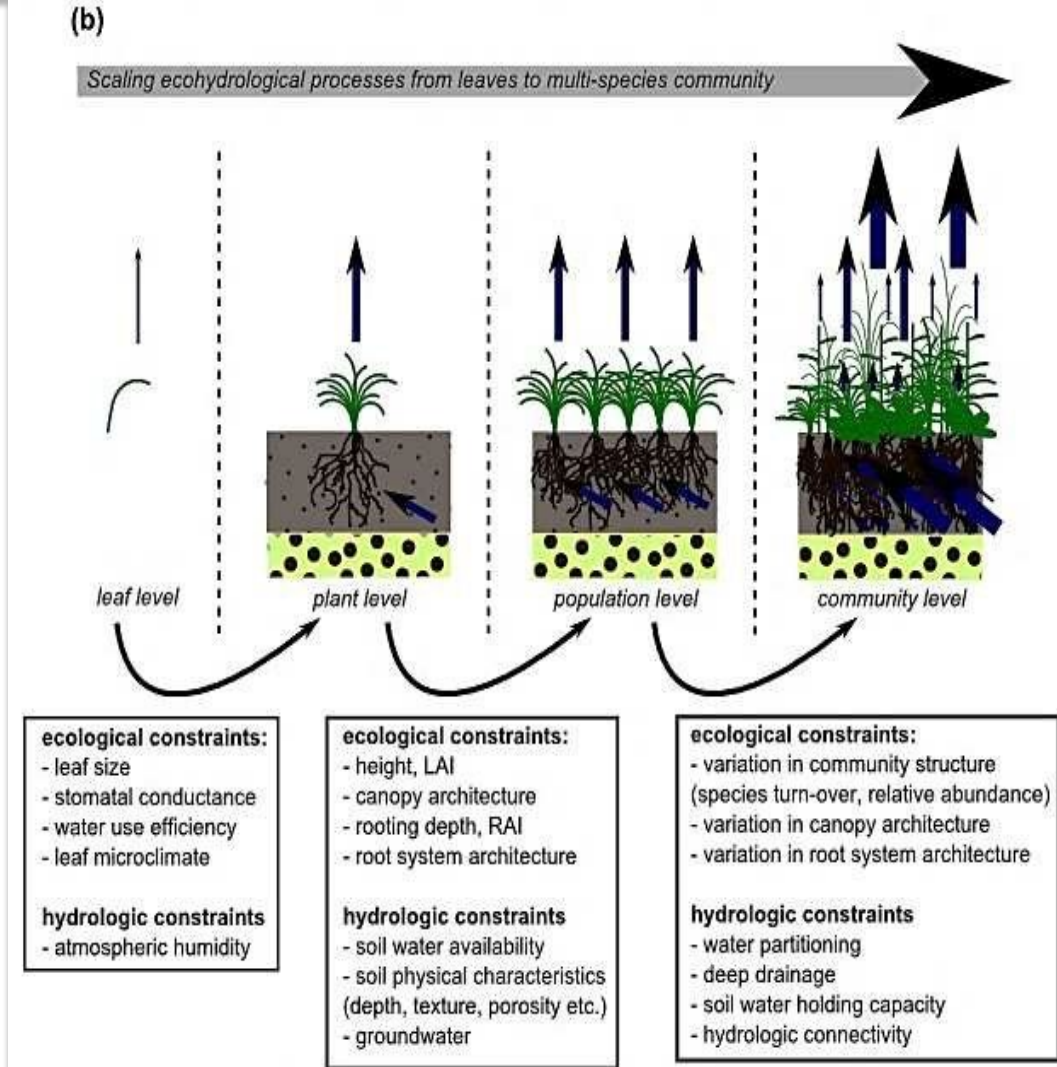
Matches amount of fertilizer type to crop needs.



**RIGHT PLACE**

Keeps nutrients where crops can use them.

Source: The Fertilizer Institute



## Water soluble fertilizers

- ♠ Water soluble fertilizers are the fertilizers which are **completely soluble** in water and leave no residue in the water.
- ♠ These are having different soluble nutrients grades available in the powder or liquid form.
- ♠ These fertilizers are applied to crops through **fertigation and foliar spray** for efficient use of nutrients leading to better yields and quality.
- ♠ The **100% water soluble fertilizers** can be defined as the NPK, NP, NK, NCa and KMgS, etc. grades of fertilizers which are completely soluble in water and can be applied in the crops.
- ♠ These fertilizers have been included in **Fertilizer Control Order (FCO), 1985**.
- ♠ Enhancing sustainable food productions and export business require proper use of available land, water and fertilizers which includes:

1. Scientific usage of foliar nutrition with water soluble fertilizers. **KKM:LUD, DOA. 10**

## Characteristics of Water-Soluble Fertilizers

1. The nutrient element must be present in readily available form to the plants.
2. High purity, fully soluble fertilizer, composed entirely of plant nutrients.
3. P and K are in assailable forms ( $K^+$  and  $H_2PO_4^-$ ).
4. Have lowest salt index.
5. Sodium and chloride free.
6. No heavy metals.
7. Balanced nutrient composition.

## Methods of Application of Water-Soluble Fertilizers

1. Starter solutions.
2. Foliar application.
3. Drip fertigation.
4. Injection into soil.
5. Aerial application.

## Advantages of Water-Soluble Fertilizers

1. WSF is available in two forms: foliar and fertigation. Depending on the application, they can also be used in the soil.
2. Minimizing soil pollution, soil and water erosion are prevented.
3. Wide ranges of nutrient grades are available.
4. Fertilizer use efficiency is more than the conventional methods.
5. Reduced labor input.
6. Wide ranges of nutrient grades are available.
7. Even distribution of nutrients throughout the root zone.
8. Timely application nutrients possible.
9. Fertilizer use efficiency is more than the conventional methods.

## Limitations of Water-Soluble Fertilizers

1. Good quality water is very essential.
2. Costly and limited availability of water-soluble fertilizers.
3. Infestation of insects, pest and diseases increase.
4. Have scorching effect if used at higher dose.
5. High cost of initial investment.
6. Can't be pressurized for smaller area.

**Good water quality** is determined by its “**lack of impurities**,” that is, lack of contaminants. Water pollution can occur when physical or chemical contaminants enter the water source, thus becoming a potential risk for human health and even transmitting several dangerous diseases.

## Future Line of Work

1. There is a need to standardize the best dosage of water-soluble fertilizers that are commercially available for foliar nutrition in various pulse and oilseed crops. Need to study the compatibility of water-soluble fertilizers with insecticides in pulse and oilseed crops
2. Popularization of water-soluble fertilizers those are commercially available for foliar nutrition in Indian Agriculture.

# Water quality is key when choosing the right water-soluble fertilizer

**Starting point to determine the best water-soluble fertilizer in your growing circumstances: water quality. The importance is often underestimated.**

- ♣ Fertilizer and water have to work in perfect harmony so the fertilizer will contribute to in the best possible way to produce high quality plants with a high sales price.
- ♣ Irrigation water quality is the root cause of many crop and growth problems.
- ♣ That's why you need to have your water analyzed, so you can pick the right fertilizer for your particular crop and growing situation.

## **Step 1:**

Have your irrigation water analyzed (irrigation water is the water used to feed and to water your plants). Don't just test the pH and EC values: the level of bicarbonate ( $\text{HCO}_3$ ) as well as the composition (the different elements) is also key.

## **Step 2:**

Determine whether acidification of the water is needed. We recommend acidifying water if the bicarbonate levels are higher than 2.5mmol/liter (=152.75g/l). The right way to acidify depends on a number of factors. Please contact your ICL SF advisor for tailor-made advice. Remember that the quality of water can change when you mix spring water with rainwater. It is also important to remember to change your fertilization plan if your rainwater is replenished.

## **Step 3:**

Select the right Peters or Universal fertilizer for your situation.

## What are the Core Components in WSFs?

- ♠ Water soluble fertilizers are based on the three essential plant macronutrients: nitrogen (N), phosphorus (P), and potassium (K).
- ♠ Out of the total of sixteen elements necessary to sustain plant life, N-P-K will always be the leading ingredients of water soluble fertilizers.
- ♠ With foliar application, N-P-K are considered mobile nutrients and will move upward and downward from the point at which they were taken up and are transported out of the leaves to growing parts with higher demands (i.e. buds, **Water Soluble Fertilizers (WSFs) dissolve completely in water.** Nutrients delivered through WSFs are more efficiently absorbed by the plant as compared to those supplied through traditional fertilizers. With WSFs, it is easy to make available to the plant precise controlled amount of nutrient in a given time period.

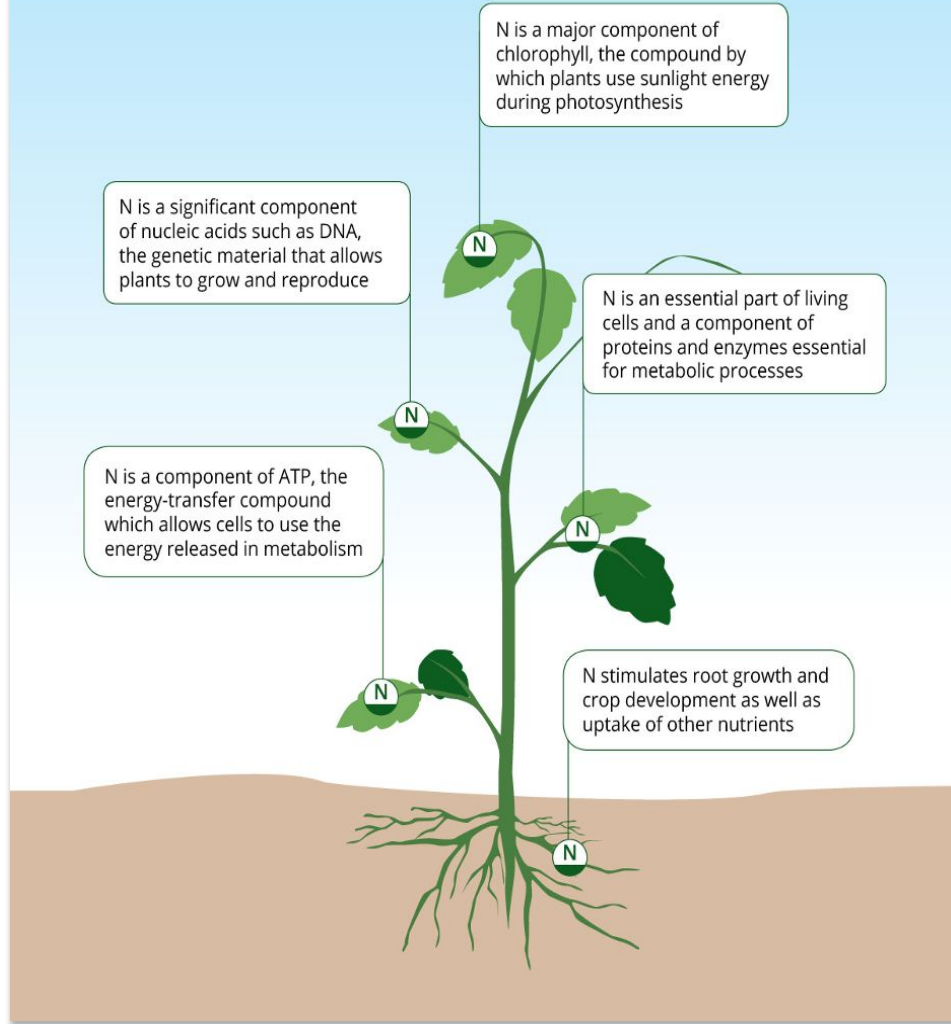
# Nitrogen

- Nitrogen is a major component of essential structural, genetic, and metabolic compounds in plant cells.
- It is also a building block for numerous organic compounds including amino acids, proteins, nucleic acids, enzymes, and chlorophyll.
- Of all essential nutrients, nitrogen is considered the most critical nutrient for adequate crop growth, development, and yield.



## NITROGEN

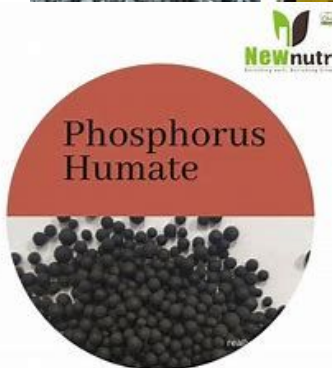
The role of nitrogen in crop production





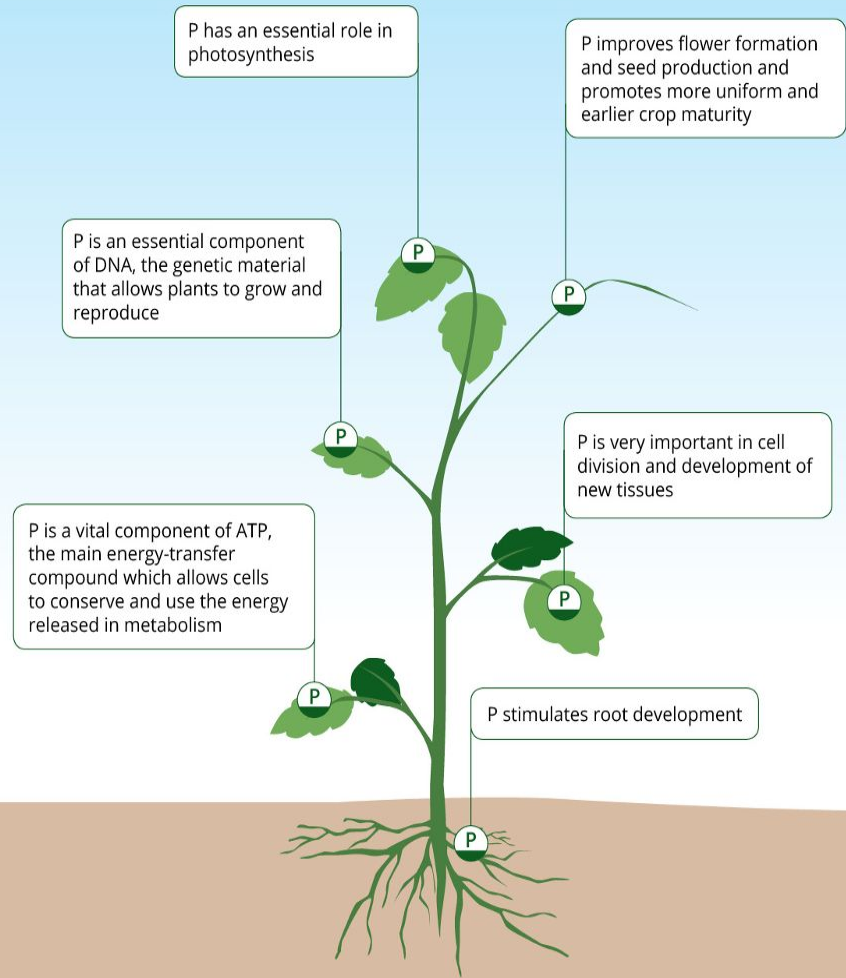
# Phosphorus

- Phosphorus is an essential nutrient, both as a component of several key **plant structural compounds** and as a catalyst in numerous key **biochemical reactions** in plants.
- One of the most important roles of phosphorus is capturing and converting **the sun's energy** into useful plant compounds.



## PHOSPHORUS

The role of phosphorus in crop production



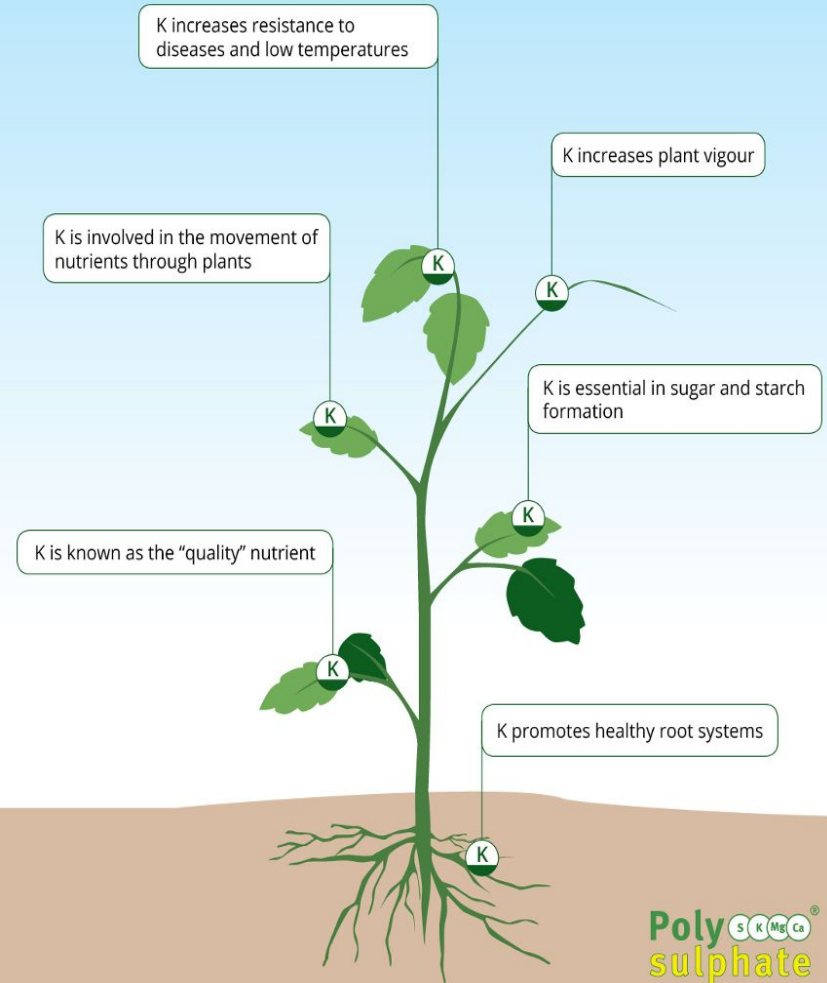
# Potassium

- Potassium is the third essential macronutrient for plant growth and development.
- Plants take up large amounts directly from the soil.
- Potassium helps plants to increase yields, improve their quality and nutrition value, and enhance the ability of plants to resist diseases, insects, cold and drought stresses, and other adverse conditions.
- It also helps in the development of a strong and healthy root system and increases the efficiency of the uptake and use of nitrogen and other nutrients.



## POTASSIUM

The role of potassium in crop production



Poly <sup>S</sup> <sup>K</sup> <sup>Mg</sup> <sup>Ca</sup>  
sulphate

## What are the Principal Benefits of applying WSFs?

- ♠ Because of the highly accurate levels of distribution that are achieved through water soluble fertilizer, nutrition is applied evenly, both in terms of time and quantity, throughout the entire growth cycle while lowering the potential of damage by salt being dosed in an uneven pattern throughout the cultivated area.
- ♠ Another added benefit is that applying soluble fertilizers helps to decrease the variation of nutrient concentration in soil.
- ♠ Other pluses include decreases in levels of fertilizer leaching with a reduction in environmental impact while allowing for accurate application of trace elements, such as boron (B), copper (Cu), iron (Fe), molybdenum (Mo), manganese (Mn) and, zinc (Zn).
- ♠ These micronutrients, while present in almost minute quantities in the water soluble fertilizers, play a vital part in interacting between the macronutrients (which make up the bulk of fertilizer and are essential to achieve continuous growth) and the healthy growth of plants, even when applied in the most minute of quantities.
- ♠ With foliar application, micronutrients are considered immobile nutrients, which means that they are only distributed within the leaf and do not undergo considerable translocation to other parts of the plant, unlike macronutrients.

# "Water Soluble Fertilizers Market"

♠ "Water Soluble Fertilizers Market" is expected to witness significant growth in the coming years, primarily driven by the growing demand for **(Flower and Fruit, Agriculture, Others)**.

♠ Based on the type, the market can be segmented into **(NPK Water-soluble, Humic Acid Water-soluble, Amino Acid Water-soluble, Others)**.

♠ The report presents the research and analysis provided within the Water Soluble Fertilizers Market Research is meant to benefit stakeholders, vendors, and other participants in the industry.

♠ The Water Soluble Fertilizers market is expected to grow annually by magnificent



# The Largest Manufacturers of Water Soluble Fertilizers Market Worldwide

- ICL Specialty Fertilizers
- SQM
- National Liquid Fertilizer
- Plant Marvel
- Miller Chemical & Fertilizer
- Doggett
- Ferti Technologies
- Timac Agro USA
- Garsoni International
- Sun Gro Horticulture
- PRO-SOL
- Grow More
- K+S
- Haifa
- Yara
- Master Plant-Prod



## Short Description About Water Soluble Fertilizers Market

*The Global Water Soluble Fertilizers market is anticipated to rise at a considerable rate during the forecast period, between 2023 and 2030.*

*In 2022, the market is growing at a steady rate and with the rising adoption of strategies by key players, the market is expected to rise over the projected horizon.*

Soluble Fertilizer is means a soluble fertilizer which dissolved in water or diluted by water, it is liquid or solid fertilizer, **mainly used in irrigation fertigation, foliar fertilization, soilless cultivation, seed soaking dipping and other related areas.**

### **Market Analysis and Insights: Global Water Soluble Fertilizers Market**

Due to the COVID-19 pandemic, the global Water Soluble Fertilizers market size is estimated to be worth USD million in 2021 and is forecast to a readjusted size of USD million by 2028 with a (Compound Annual Growth Rate- CAGR) of Percent during the forecast period 2022-2028. Global Water Soluble Fertilizers key players include Haifa Chemicals, Yara, Arab Potash Company, Omex, Everris, etc.

**Global top five manufacturers hold a share about 20 %.**

**Europe is the largest market, with a share about 30 %,**

**followed by North America, with a share about 20 %.**

**NPK Water-soluble is the largest segment, with a share about 60 %.**

**The largest application is Agriculture, followed by Flower and Fruit.**

# Global Water Soluble Fertilizers Scope and Market Size

The global Water Soluble Fertilizers market is segmented by region (country), company, by Type and by Application. Players, stakeholders, and other participants in the global Water Soluble Fertilizers market will be able to gain the upper hand as they use the report as a powerful resource. The segmental analysis focuses on sales, revenue and forecast by region (country), by Type and by Application for the period 2017-2028.

**Get a Sample Copy of the Water Soluble Fertilizers Report 2023**

**The factors are driving the growth of the Water Soluble Fertilizers Market.**

Growing demand for below applications around the world has had a direct impact on the growth of the Water Soluble Fertilizers

- **Flower and Fruit**
- **Agriculture**
- **Others**

**The types are of Water Soluble Fertilizers available in the Market.**

Based on Product Types the Market is categorized into Below types that held the largest Water Soluble Fertilizers market share In 2023.

- **NPK Water-soluble**
- **Humic Acid Water-soluble**
- **Amino Acid Water-soluble**
- **Others**

## **The regions are leading the Water Soluble Fertilizers Market.**

- North America (United States, Canada and Mexico)
- Europe (Germany, UK, France, Italy, Russia and Turkey etc.)
- Asia-Pacific (China, Japan, Korea, India, Australia, Indonesia, Thailand, Philippines, Malaysia and Vietnam)
- South America (Brazil, Argentina, Columbia etc.)
- Middle East and Africa (Saudi Arabia, UAE, Egypt, Nigeria and South Africa)

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## Water Soluble Fertilizers Market - Covid-19 Impact and Recovery Analysis:

- We were monitoring the direct impact of covid-19 in this market, further to the indirect impact from different industries.
- This document analyzes the effect of the pandemic on the Water Soluble Fertilizers market from a international and nearby angle.
- The document outlines the marketplace size, marketplace traits, and market increase for Water Soluble Fertilizers industry, categorised with the aid of using kind, utility, and patron sector.
- Further, it provides a complete evaluation of additives concerned in marketplace improvement in advance than and after the covid-19 pandemic.
- Report moreover done a pestel evaluation within the business enterprise to study key influencers and boundaries to entry.
- Our studies analysts will assist you to get custom designed info to your report, which may be changed in phrases of a particular region, utility or any statistical info.
- In addition, we're constantly inclined to conform with the study, which triangulated together along with your very own statistics to make the marketplace studies extra complete for your perspective.

## Comparison Between the Conventional Fertilizers and Water-Soluble Fertilizers

Properties	Water soluble fertilizers	Conventional fertilizers
Solubility	Readily soluble in water	Nutrient may be in soluble form carrier material not fully soluble
Uniformity of nutrient ions	Ionic distribution uniforms depending upon concentration & composition of base material used	Ionic distribution not uniform
Solubility time for preparation of solution	1 to 4 minutes in water	12 to 24 hours 25° C
Filtration of solution before application	Not required	Filtration is required
Salt index	8 to 40	It varies
Nutrient use efficiency	Very high	higher if applied in split
Cost	High	less compared to WSF

## FCO Approved Water-Soluble Fertilizers

Sl. No.	Fertilizer	Grades
1	Potassium nitrate	13-0-45
2	Mono potassium phosphate	0-52-34
3	Calcium nitrate	15.5-0-0
4	N-P-K	13-40-13
5	N-P-K	18-18-18
6	N-P-K	19-19-19
7	N-P-K	13-5-26
8	N-P-K	6-12-26
9	N-P-K	20-20-20
10	Mono ammonium phosphate	12-61-0
11	N-P-K	17-44-0
12	Potassium magnesium sulphate (K-Mg-S)	22-18-20

## Research results of water soluble fertilizers

- ✓ Foliar application of  $\text{KNO}_3$  improved the plant growth by enhancing the physiological process viz., osmoregulation, stomatal conductance, photosynthesis, protein synthesis, solute transport and nitrate metabolism. Significant increase in dry matter production was observed in chili owing to foliar application of water-soluble fertilizers.  
(Elhindi et al., 2016)
- ✓ 100% RDF + WSF 1.0% NPK @13:40:13 recorded the highest plant height, number of primary branches, stem girth, number of leaves per plant, leaf area, leaf area index and dry matter production.  
(Muthumanickam and Anburani, 2017)
- ✓ Adequate supply of N, P and K through 19:19:19 and Zn and B led to better utilization of photosynthates for reproductive growth instead of excessive vegetative growth  
(Muthumanickam and Anburani, 2017)
- ✓ The increased number of branches might also be attributed to the foliar application of  $\text{MgSO}_4$  as water soluble fertilizers at 30, 60 and 90 DAT that could have encouraged more number of auxiliary buds and resulted in more number of productive branches. Similar results of better branching with foliar application of nutrients and NPK inorganic fertilizers.  
(Muthumanickam and Anburani, 2017)

# Influence of Potassium Foliar Fertilizer Application on Cotton Yield, Yield Components, Fiber Quality, and Nutrient Use Efficiency of Three Cotton Varieties

Basal application is N:P:K rate = 86 : 24 : 90 (kg ha<sup>-1</sup>)

Due to supplementary of K-foliar, in monsoon experiments increasing

❖ fruit set formation	7 to 14 %
❖ total bolls per plant	7 to 13 %
❖ harvested bolls per plant	2 to 17 %
❖ opened bolls percentage	6 %
❖ reduce fruit shedding	(-14) to (-23) %
❖ yield per plant	5 to 16 %
❖ seed cotton yield	4 to 20 %
❖ lint yield	5 to 20 %
❖ cottonseed yield	4 to 20 %

❖ **positive effect on highest strength counts Increase 8.84 - 33.91 %**

❖ **K-foliar together with soil basal K application**

- gave the higher seed cotton yield
- improved fiber quality
- **Good yarn appearance**



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**Thank You**