Water Soluble Fertilizers

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Introduction

- Plant nutrition is the study of the chemical elements and compounds necessary for plant growth and reproduction, plant metabolism and their external supply.
- In its absence the plant is unable to complete a normal life cycle, or that the element is part of some essential plant constituent or metabolite.
- A fertilizer (American English) or fertiliser (British English) is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply plant nutrients.
- Fertilizers may be distinct from liming materials or other non-nutrient soil amendments.
- Many sources of fertilizer exist, both natural and industrially produced. For most modern agricultural practices, fertilization focuses on three main macro nutrients: nitrogen, phosphorus, and potassium with occasional addition of supplements like rock flour for micronutrients.
- Farmers apply these fertilizers in a variety of ways: through dry or pelletized or

Liquid and solid

- Fertilizers are applied to crops both as solids and as liquid.
- About 90% of fertilizers are applied as solids.
- The most widely used solid inorganic fertilizers are urea, diammonium phosphate and potassium chloride.
- Solid fertilizer is typically granulated or powdered.
- Often solids are available as prills, a solid globule.
- Liquid fertilizers comprise anhydrous ammonia, aqueous solutions of ammonia, aqueous solutions of ammonium nitrate or urea.
- These concentrated products may be diluted with water to form a concentrated liquid fertilizer (e.g., UAN = UAN is a solution of urea and ammonium nitrate in water used as a fertilizer.).
- Advantages of liquid fertilizer are its more rapid effect and easier coverage.
- The addition of fertilizer to irrigation water is called "fertigation"

Four risks of using fertilizer

- Fertilizers are increasingly popular because they successfully support plant growth and increase the yield.
- But what are the dangers of overusing fertilizers?
- Did you know that too much fertilization might cause “fertilizer burn”?
- Below more about the negative effects of using fertilizer without knowing your soil’s nutrient needs.

1. No optimal yield due to under- or over-fertilization
2. Wasting money on fertilizer your soil does not need
3. Wasting limited resources
4. Causing environmental damage due to over-fertilizing

Alisa (2019) Farming, News

1. No optimal yield due to under- or over-fertilization

- Soil testing before applying fertilizers is recommended in order to determine the soils status and nutrient need.
- Only then you know the exact type and quantity of fertilizer you need to use. If you apply fertilizer without knowing what your soil needs, you risk using too little fertilizer (under-fertilization) and not achieving optimal yield.
- If you apply too much fertilizer (over-fertilization) or apply it at the wrong time, there is a chance of "fertilizer burn" – scorching of plant foliage as a result of excess nitrogen salts.
- Injudicious use of fertilizers may result in crop damage and yield loss.

2. Wasting money on fertilizer your soil does not need

- If you do not know what nutrients are already present in your soil, you might use fertilizers that your soil is already abundant of.
- That is simply a waste of money.
- Excessive fertilizer will not improve your yield and might have a negative effect

Excessive fertilizer

- Release of harmful greenhouse gases into the atmosphere
- Eutrophication of waterways
- Environmental pollution
- Decreased soil quality
- Increased soil acidity
- Nutrient runoff
- Groundwater contamination
- Disruption of natural nutrient cycles

3. Wasting limited resources

- 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

4. Causing environmental damage due to over-fertilizing

- 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 qu

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".

Eutrophication

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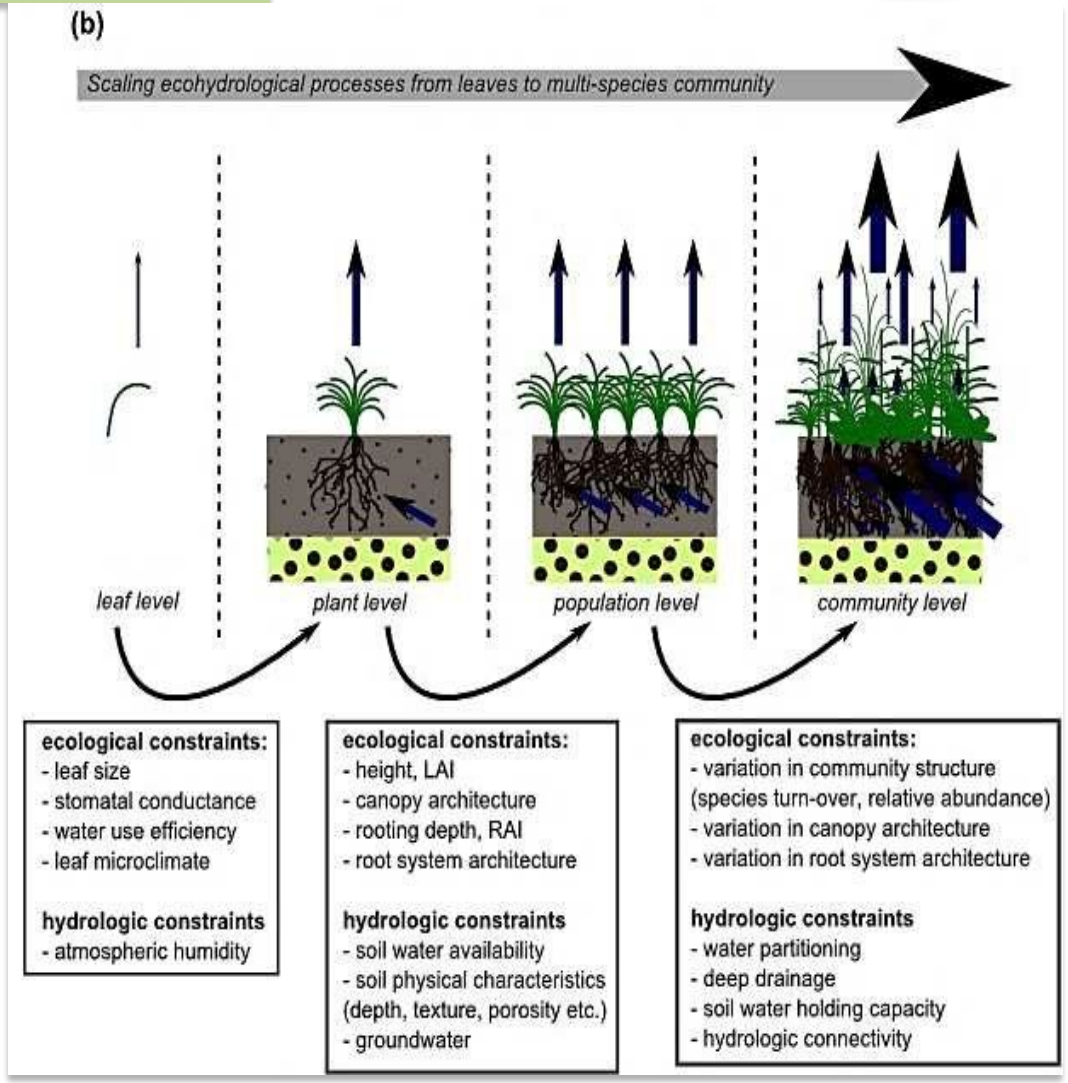
The **Baltic Sea** is home to seven of the world's 10 largest marine dead zones. Increased runoff from agricultural fertilisers and sewage has exacerbated the eutrophication process.

cultural eutrophication: it is caused by **human activities** because they are responsible for the addition of **80% nitrogen** and 75% phosphorous in lake and stream.

The Baltic Sea is home to seven of the world's 10 largest marine dead zones. Increased runoff from agricultural fertilisers and sewage has exacerbated the eutrophication process. Overfishing of Baltic cod has intensified the problem. Cod eat sprats, a species that eats microscopic zooplankton, which in turn eat algae. Fewer cod and more sprats mean more algae and less oxygen. The spreading dead zones are starting to reach the cod's deep-water breeding grounds, further endangering the species.

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.



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.

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 qualityis 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.

The Importance of Water Quality when using Water Soluble Fertilizers.

To achieve maximum results, the irrigator will then be required to make some simple calculations to ensure that, once released into the system, the fertilizer is evenly spread throughout the area during the irrigation span.

With this information, the irrigator will be able to calculate and moderate the vital factor of water pressure differential in which the water pressure at the input and output access to the tank should have a differential of around 10%.

This differential will allow the salt to dissolve and flow freely.

The difference in input and output pressure can be easily controlled by a simple turn of a tap and a reliable set of pressure gauges.

If correctly calculated and stringently observed, this simple procedure will ensure that the soluble fertilizer will be evenly distributed over extensive areas within predetermined time scales to the highest accuracy levels.

When doing these calculations, it's important to keep in mind that water soluble fertilizers have a set solubility limit, and increasing levels above the manufacturer's set threshold will not increase fertilizer distribution levels.

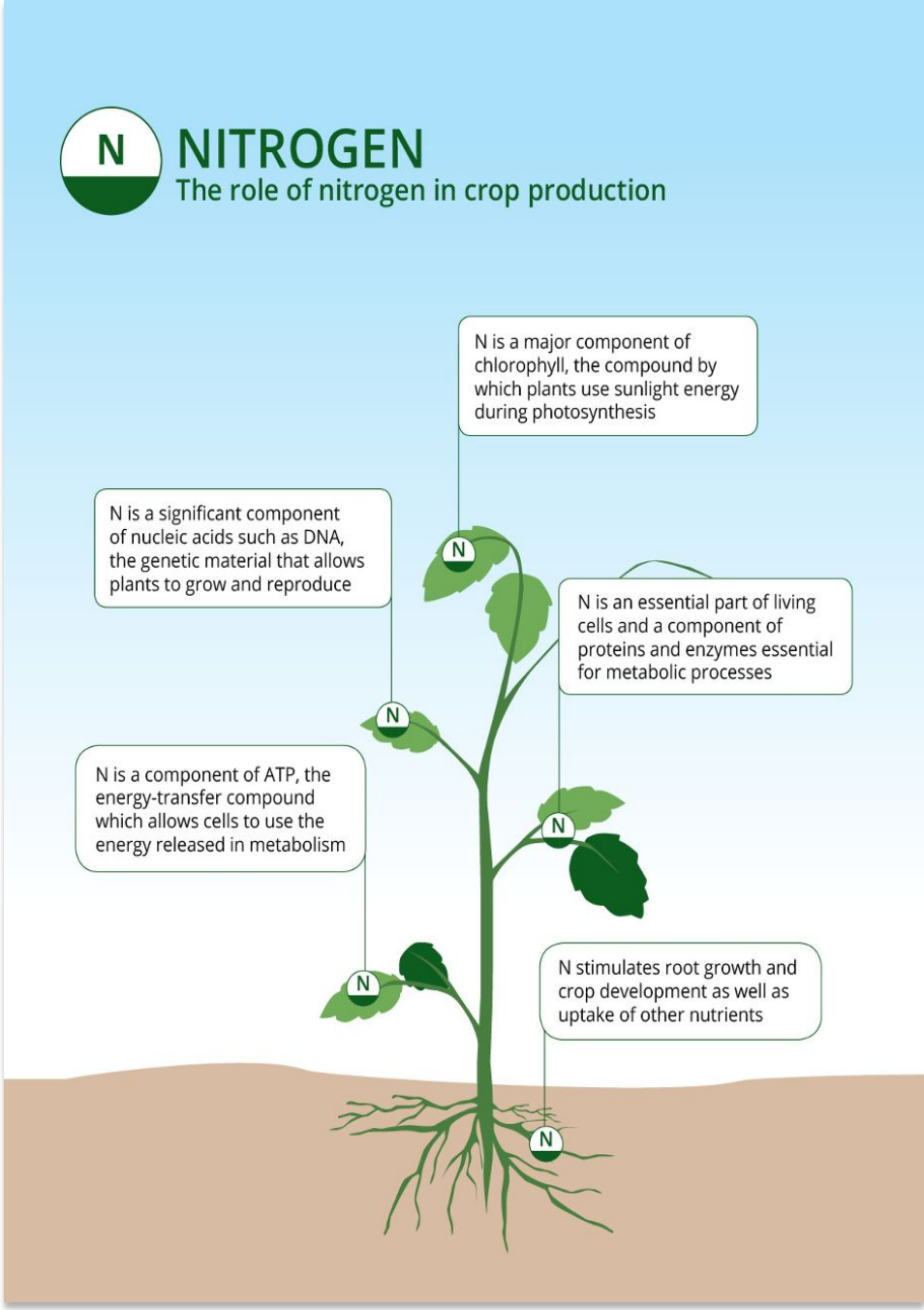
Results will be achieved irrespective of the irrigation method either drip, sprinkler, or even the massive irrigation pivots used in large-scale open-field cultivation.

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, younger leaves, growing roots).

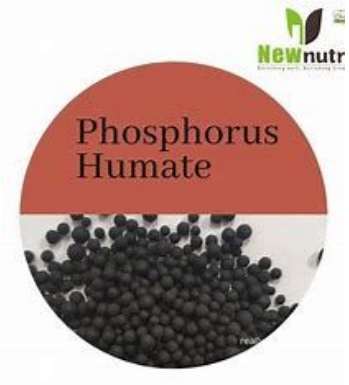
Nitrogen

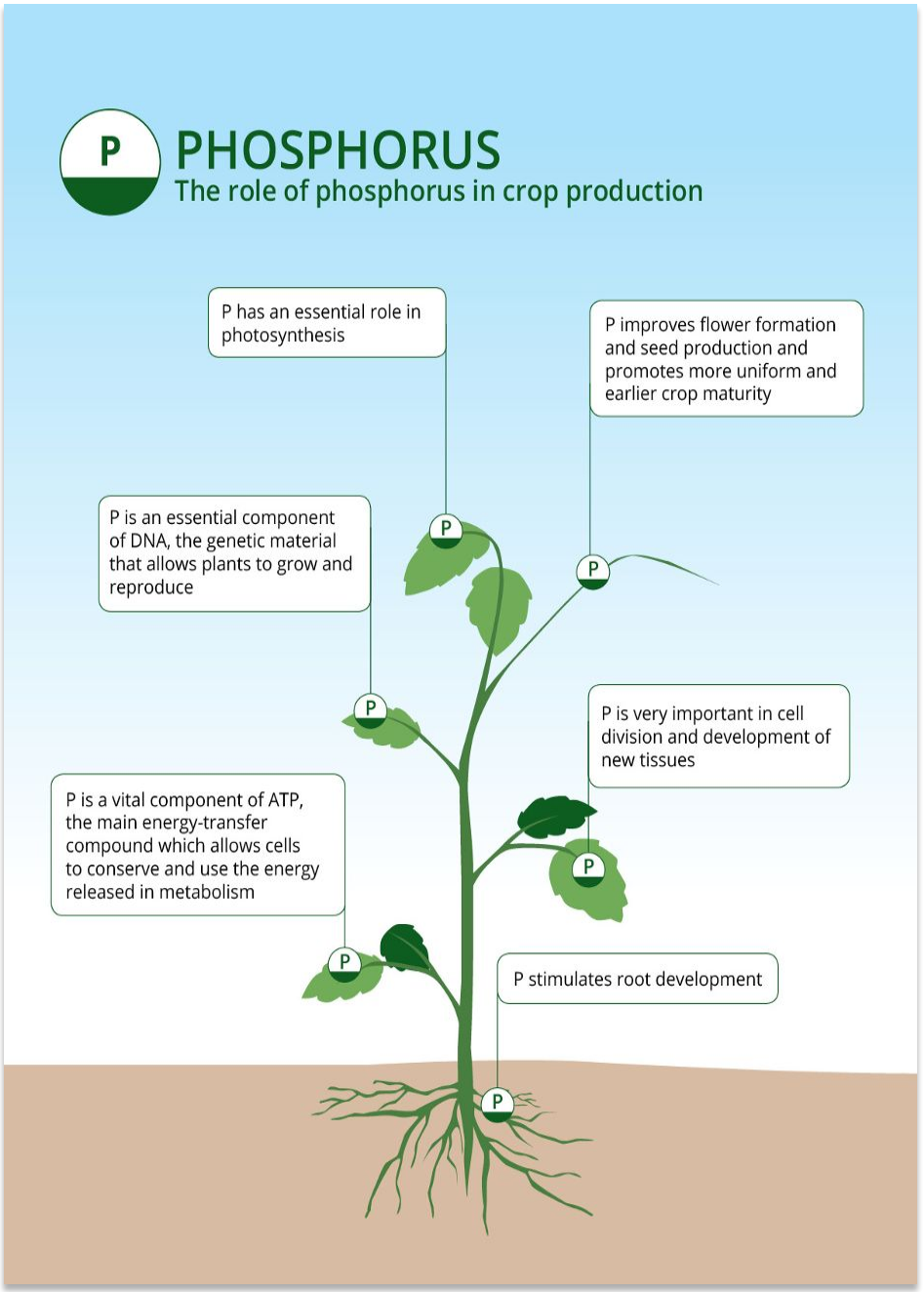
- Nitrogen is a major component of essential structural, genetic, and metabolic compounds in plant cells.
- It is also a building block for numerous organic compounds including amino acids, proteins, nucleic acids, enzymes, and chlorophyll.
- Of all essential nutrients, nitrogen is considered the most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



Phosphorus

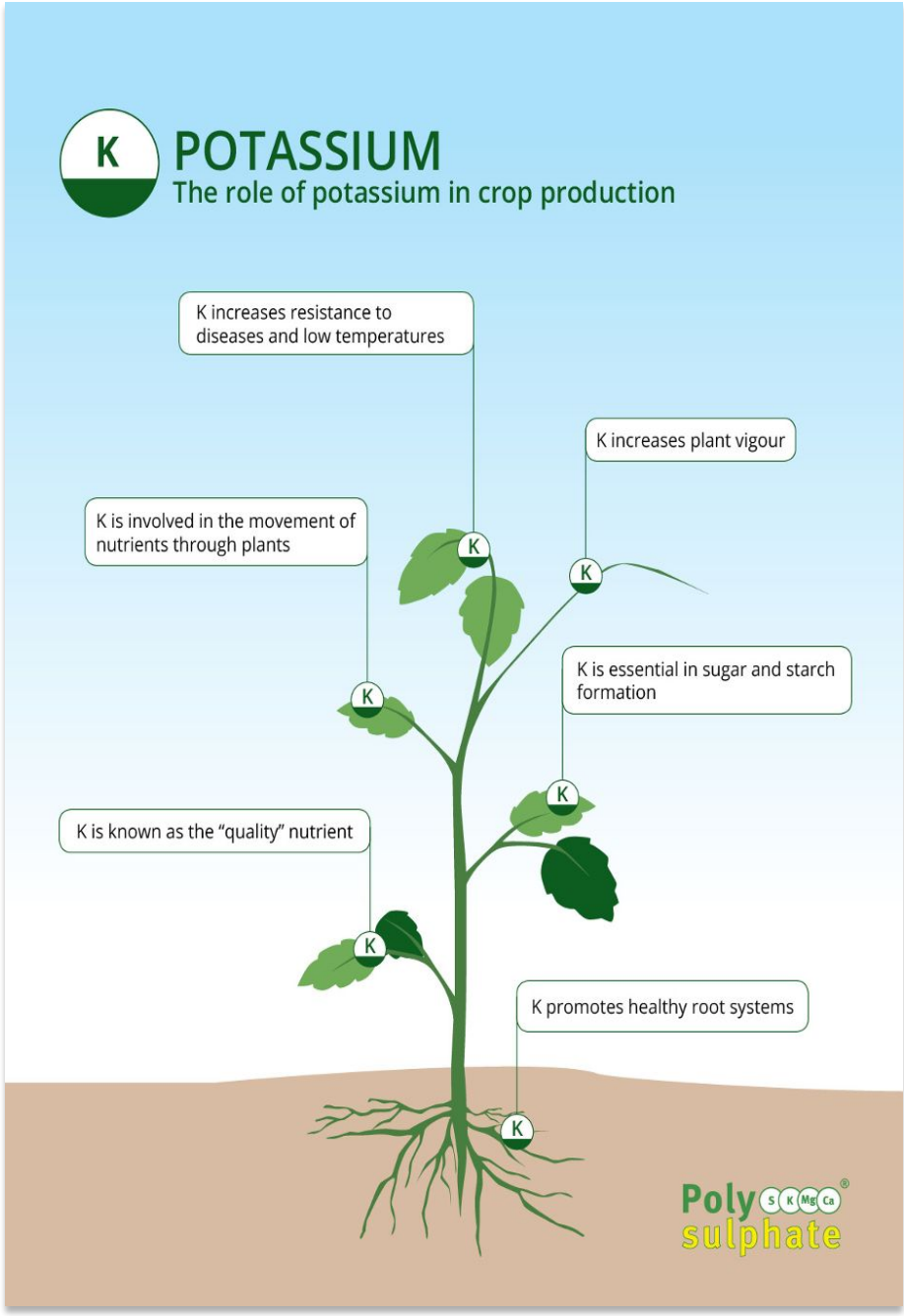
- Phosphorus is an essential nutrient, both as a component of several key plant structural compounds and as a catalyst in numerous key biochemical reactions in plants.
- One of the most important roles of phosphorus is capturing and converting the sun's energy into useful plant compounds.





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.



What are the Principal Benefits of applying WSFs?

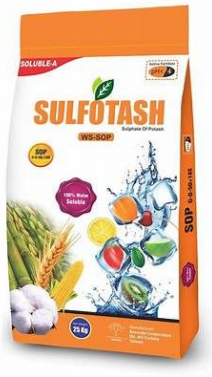
- Because of the highly accurate levels of distribution that are achieved through water soluble fertilizer, nutrition is applied evenly, both in terms of time and quantity, throughout the entire growth cycle while lowering the potential of damage by salt being dosed in an uneven pattern throughout the 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 %.
In terms of product, NPK Water-soluble is the largest segment, with a share about 60 %.
And in terms of application, the largest application is Agriculture, followed by Flower and Fruit, etc.

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.

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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 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 MgSO4 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^{-1})

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**

Organic water soluble fertilizers

Organic water soluble fertilizers are environmentally friendly solutions for healthy, beautiful plants.

These are;

- mixed with water and sprayed on plants leaves or used as a soil drench for instant uptake of nutrients.
- made from natural sources like plant residue, livestock manure, or hydrolyzed protein concentrate and kelp.
- provide plants with essential macronutrients and micronutrients, as well as vitamins, minerals, and plant growth hormones.
- digested by soil microorganisms, which enhance the soil fertility and structure.
- resistant to leaching and can be applied more frequently without over-fertilizing·