



## Specialty Fertilizers and their Importance in Agriculture

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Fertilizers are crucial for crop production, and India's fertilizer use saw significant growth following the introduction of high-yielding varieties in the mid-1960s. By 2005, India was the world's second-largest fertilizer consumer by total nutrients. Despite this, per-hectare fertilizer consumption remains low and imbalanced at a macro level. This imbalance has resulted in widespread multi-nutrient deficiencies, reduced nutrient use efficiency, lower partial factor productivity, decreased crop yields and farm profits, and increased environmental pollution. The rising demand for high-quality crops, environmental concerns, and the push for better nutrient use efficiency have spurred the development of specialty fertilizers globally. These fertilizers offer growers enhanced nutrient availability, control over bacterial activity, and precise nutrient delivery tailored to specific soil conditions, crop types, and climatic factors. Application schedules are also optimized based on crop growth stages and soil characteristics.

Specialty fertilizers encompass a diverse range of products, from basic stabilized nitrogen fertilizers used in broad-acre cropping systems to premium products like water-soluble fertilizers (WSFs) for foliar application and drip fertigation, as well as controlled-release fertilizers for turf and ornamental plants. There is no single definition or category for specialty fertilizers. According to the International Fertilizer Association (IFA), specialty fertilizers include controlled-release fertilizers (CRFs), slow-release fertilizers (SRFs), sulfur-coated urea (SCU), stabilized nitrogen fertilizers (SNFs), WSFs, liquid NPKs, and chelated micronutrients and boron. In India, these are broadly classified into water-soluble fertilizers, neem-coated urea, fortified fertilizers, customized fertilizers (CFs), micronutrient fertilizers, and liquid fertilizers.

Indian fertilizer companies started the R&D work on specialty products in early 1980s. IFFCO developed urea super granule (USG), a slow release nitrogenous fertilizer and conducted large scale field demonstrations/trials to evaluate its agronomic efficacy. These demonstrations /trials established the superiority of USG over the prilled urea and USG was included in the FCO in 1990. The absence of suitable applicator for placement of USG in soil was the main constraint in its adoption by the farmers. The National Fertilizers Limited (NFL) developed urea ammonium nitrate (UAN), a liquid nitrogenous fertilizer. Based on agronomic advantages, UAN was included in FCO in 1995. Again, the use of UAN could not be commercialized due to the transportation and storage problems.

### **Nitrogen compounds**

Calcium nitrate (CN) contains two essential plant nutrients: calcium and nitrogen, the latter in plantavailable nitrate form. It is produced by reacting limestone with nitric acid and can be manufactured in water-soluble form and is therefore suitable for fertigation. Yara International is a leading producer with a large production facility located in Porsgrunn, Norway.

Ammonium thiosulfate also contains two essential plant essential nutrients, nitrogen and sulfur, and is water soluble. Tessenderlo Kerley is a leading producer of this product under the brand “THIO-SUL”. Besides supplying nutrients, “THIO-SUL” also acts to slow the hydrolysis of urea, effectively acting as a slow-release product. It is commonly mixed with urea ammonium nitrate (UAN) solutions which are widely used in the broad acre crop markets, primarily in North America and Europe.

### **Phosphate compounds**

Granular monoammonium and diammonium phosphate (MAP and DAP) are used worldwide and are the leading commodity phosphate-containing products. Soluble versions of these products, more commonly MAP, are produced by using a purer phosphoric acid as a raw material.

Superphosphoric acid (SPA) is widely used to produce ammonium polyphosphate (APP), a liquid fertilizer which can be applied directly or mixed with UAN and other fertilizer solutions. Typical grades are 10-34-0 and 11-37-0. This product is widely used in North America.

Many producers of commodity grade DAP and MAP are adding secondary and micronutrients to respond to increasingly sophisticated demands of buyers for specialties. Both OCP and Mosaic produce significant quantities of DAP and MAP with sulfur in different ratios. Mosaic has a range of variations which are branded as “Microessentials” (N, P, S and Zn) and a new product called ‘Aspire’ (K and B)

### **Potash compounds**

Straight potassium chloride (muriate of potash [MOP] or KCl) is the most widely used source of potash fertilizer and can be applied either directly in a blend or as a raw material in a NPK complex. In addition there are several dry potash products with special properties.

Potassium sulfate (SOP) contains two essential nutrients, potassium and sulfur, but also has some important niche applications. For certain crops, notably many fruits and vegetables, an excessive supply of chloride is undesirable as it negatively affects yields. This is prevented by using potassium sulfate.

K+S in Germany is a leading supplier of potassium sulfate which is produced from the naturally occurring mineral form, but it can also be produced by reacting MOP and sulfuric acid. Similarly, Mosaic produces significant quantities of its brand “KMag” with various grades containing ratios of potassium, magnesium and sulfur.

Potassium nitrate (NOP) offers similar benefits to SOP providing two essential nutrients, nitrogen and potassium, without chloride. In some situations NOP is preferred to SOP because of its balanced ratio of the two nutrients it contains in fertigation systems. The world’s largest producer of NOP is SQM of Chile followed by HAIFA of Israel and Kemapco of Jordan although Kingenta of China is growing fast in NOP production.

### **NPK compounds**

The boundaries between commodity grade and specialty complex NPKs are blurry. There are a potentially limitless number of alternative grades of product which can be manufactured from the basic commodity fertilizers such as urea, ammonium sulfate, DAP, and MOP, as well as secondary and micronutrient materials to make custom grades. Some NPK compound

products though have clear specialty features, for example those based on potassium sulfate or potassium nitrate, which are therefore chloride free, and give a final product which is fully soluble. NPK compound products containing faster release nitrate nitrogen produced by chemical granulation (ODDA process) rather than urea-based produced by physical (steam) granulation are strongly preferred in some markets.

They play a crucial role in modern agriculture for several reasons:

**Precision Nutrition:** Specialty fertilizers allow for tailored nutrient delivery, targeting the specific needs of different crops or soil types. This can help address deficiencies or imbalances, optimizing plant growth and productivity.

**Improved Efficiency:** By providing nutrients in forms that are more readily available to plants, specialty fertilizers can enhance nutrient uptake and reduce losses to the environment. For example, slow-release fertilizers can provide a steady supply of nutrients over time, reducing the risk of leaching and runoff.

**Enhanced Crop Quality and Yield:** Certain specialty fertilizers are designed to improve crop quality, such as increasing fruit size, color, or sugar content. For instance, potassium-based fertilizers can enhance fruit development and disease resistance.

**Soil Health:** Some specialty fertilizers improve soil structure and health. For example, biofertilizers and organic amendments can enhance microbial activity and soil fertility, leading to better long-term soil health.

**Targeted Solutions for Specific Conditions:** Specialty fertilizers can be formulated to address specific soil conditions or crop requirements. For instance:

**Chelated Micronutrients:** These help correct deficiencies in essential trace elements like iron, zinc, or manganese, which are crucial for various plant functions.

**Fertility Boosters:** Products like humic and fulvic acids can enhance nutrient availability and soil structure.

**Controlled-Release Fertilizers:** These release nutrients slowly over time, matching the crop's growth stages and reducing the frequency of application.

**Environmental Protection:** Using specialty fertilizers can reduce the risk of over-fertilization, which can lead to environmental issues such as nutrient runoff into waterways. Precision application based on specific crop needs helps mitigate these risks.

**Economic Efficiency:** Though specialty fertilizers might be more expensive upfront, their targeted application can lead to increased crop yields and reduced waste, making them economically beneficial in the long run.