

Calcium Nitrate

Calcium nitrate is a highly soluble source of two plant nutrients. Its high solubility makes it popular for supplying an immediately available source of nitrate and calcium directly to soil, through irrigation water, or with foliar applications.

Production:

Phosphate rock is acidified with nitric acid to form a mixture of phosphoric acid and calcium nitrate during the nitrophosphate fertilizer manufacturing process. Ammonia is then added to neutralize excess acidity. Calcium nitrate crystals precipitate via a temperature gradient and are separated as the mixture is cooled. With the ammonia addition and crystallization, a double salt is formed [$5 \text{ Ca}(\text{NO}_3)_2 \cdot \text{NH}_4\text{NO}_3 \cdot 10 \text{ H}_2\text{O}$, referred to as 5:1:10 double salt] and is considered the commercial grade of calcium nitrate. Hence, small amounts of ammonical N may also be present in this grade of calcium nitrate. Calcium nitrate is also manufactured by reacting nitric acid with crushed limestone forming either the 5:1:10 double salt or calcium nitrate tetrahydrate ($\text{Ca}(\text{NO}_3)_2 \cdot 4 \text{ H}_2\text{O}$). The latter product is often produced as a wet crystal or a mesh and is subject to specific regulation with respect to handling and safety. Prilling and granulating are the most common methods of making particles ready for field use.

Calcium nitrate is very hygroscopic (absorbs water from the air), so when intended for soil application, proprietary coatings are applied to minimize moisture uptake. Calcium nitrate intended for hydroponics or fertigation does not contain a conditioner, or it may be sold as a clear fluid fertilizer ready for use.

Chemical Properties

Chemical formula: **Solid** $5 \text{ Ca}(\text{NO}_3)_2 \cdot \text{NH}_4\text{NO}_3 \cdot 10 \text{ H}_2\text{O}$
 Nutrient Content: 15.5% N, 19% to 22 Ca, <1.5% NH_4
 pH (10% Solution): 6.0
 Water solubility (20°C) 1200 g/L

Chemical formula: **Liquid** $\text{Ca}(\text{NO}_3)_2 \cdot 4(\text{H}_2\text{O})$
 Nutrient Content: 8 to 9% N, 11 to 12% Ca, <1% NH_4
 pH: 5 to 7
 Density (20°C): 1.47 to 1.48 kg/L, 12.2 to 12.3 lb/gal



Granular form of calcium nitrate



Liquid form of calcium nitrate

Agricultural Uses:

Calcium nitrate is popular in agronomic situations where a readily soluble source of nitrate or calcium is needed. Nitrate moves freely with soil moisture and can be immediately taken up by plant roots. Unlike many other common N fertilizers, $\text{Ca}(\text{NO}_3)_2$ application does not acidify soils since there is no acidity producing nitrification of ammonium occurring. Broadcast applications of $\text{Ca}(\text{NO}_3)_2$ are desirable in some circumstances because the risk of ammonia volatilization is eliminated with its use. In addition, some crops prefer nitrate sources of N.

Applications of $\text{Ca}(\text{NO}_3)_2$ are also used to provide supplemental Ca for plant nutrition. Some soils may contain considerable amounts of Ca, but it may not be sufficiently soluble to meet plant demands. Since Ca is not mobile in the plant it is important to apply Ca just-in-time in critical growth stages. Solutions of $\text{Ca}(\text{NO}_3)_2$ are commonly added to irrigation water and to foliar and fruit sprays to overcome such shortcomings that can affect yield and/or quality (such as apple bitter pit), or to meet peak Ca demands during critical growth periods. Part of the popularity of $\text{Ca}(\text{NO}_3)_2$ also arises from its chloride-free nature and $\text{Ca}(\text{NO}_3)_2$ can have an ameliorating effect under saline growing conditions, combating the negative effects of Na and Cl. Research has shown that a healthy plant with adequate Ca alleviates biotic and abiotic stresses such as fungal disease, and stresses due to drought, heat, or cold. Hence $\text{Ca}(\text{NO}_3)_2$ is widely used in intensive cropping systems that have a high focus on crop quality.

Management Practices

There are no special practices required for the use of $\text{Ca}(\text{NO}_3)_2$ beyond the need to keep nitrate from moving below the root zone.

To avoid precipitating insoluble fertilizer salts, $\text{Ca}(\text{NO}_3)_2$ should not be mixed with soluble phosphate or sulfate fertilizers in nutrient solutions or while fertigating. The extreme hygroscopic nature of solid $\text{Ca}(\text{NO}_3)_2$ makes it important to store it in a cool and dry environment.

Calcium nitrate (double salt) is not classified as an oxidizer by government agencies, so there are no special restrictions on transport and handling as there may be for ammonium nitrate. However calcium nitrate tetrahydrate is classified as a 5.1 oxidizing agent that can, in conjunction with oxygen, cause or increase the combustion of other materials and may require special attention depending on local regulations.

Non-Agricultural Uses:

Calcium nitrate is used for waste water treatment to minimize the production of hydrogen sulfide. It is also added to concrete to accelerate setting and reduce corrosion of concrete reinforcements.