

Calcium Ammonium Nitrate (CAN)

Properties

Calcium ammonium nitrate is one of the most widely used top dressing fertilizers in plant production, except for rice. It contains 26% nitrogen (N) and while half of it presents in ammonium (NH_4) form, the other half does in nitrate (NO_3). Nitrate nitrogen is quickly absorbed by plant roots during rapid plant development and fruiting stages. Depending on the soil conditions, the most of nitrogen in ammonium form is transformed into nitrate (NO_3) nitrogen by the nitrogen bacteria in soil so plants do not suffer from nitrogen deficiency. Except for rice, 75% of nitrogen uptake by all crops during their development periods is in the form of nitrate nitrogen.

Agricultural Use

Calcium ammonium nitrate fertilizer is used as a top dressing fertilizer in advance of hoeing or during/in prior to irrigation all crop plants particularly for cereals such as wheat and barley. If plants do not receive sufficient nitrogenous top dressing fertilizers such as calcium ammonium nitrate, plants show stunted growth, leaves remain small and their colour turns into pale or yellowish green. Excess application, on the other hand, causes overdevelopment and delays maturing. Since it has neutral reaction characteristics, it is appropriate for all soil types.

Application

Where calcium ammonium nitrate fertilizer is applied incorporating to soil or prior to rainfall and irrigation, no nitrogen loss ammonia (NH_3) occurs as it is the case with urea fertilizer. When fertilizer dissolves in water, ammonium (NH_4) and nitrate (NO_3) in its composition dissociate. Since ammonium is positive (+) charged, the negative (-) charged clay minerals and other colloids in the soil retain them, so it is not drained away with irrigation water. However nitrate is negative (-) charged, it cannot be completely retained by clay minerals and other colloids and they can partly be drained away from root zone due to excessive rainfall or excessive irrigation particularly in sandy soils. Therefore, calcium ammonium nitrate fertilizer must be applied in several times according to plants nitrogen demand, age, and irrigation interval.

Misinformation on CAN

Since calcium ammonium nitrate fertilizer has neutral characteristics, it has no effect on soil pH. Therefore, the expression that "*it increases the pH value of soil*" is not true. The assumption that calcium ammonium nitrate fertilizer increases soil pH (or other ammonium nitrogen fertilizers with 26% nitrogen content marketed under different trade names) is based on the inclusion of

lime (CaCO_3) or dolomitic lime ($\text{CaCO}_3 + \text{MgCO}_3$) that need to be added during the manufacturing process to reduce the explosive characteristics of nitrate. Since lime dissolves in water very slowly and slightly, in order for 1 kg of lime to dissolve and dissociate into Ca^{+2} and CO_3^{-2} and to increase soil's pH value, 66-100 tons of water and very long time are required. Thus, calcium ammonium nitrate fertilizer does not change the soil pH value.

Another misinformation on calcium ammonium nitrate fertilizer is that it has a liming effect and increase lime amount in soil. The tilled upper soil layer is nearly 20-cm thick. This corresponds to an area of 1000 m^2 surface size on decare and nearly 200 m^3 soil volume based on a depth of 20 cm. Since the density of a medium-structured soil is 1.25 kg/liter, 1 decare area contains $200 \times 1.25 = 250$ tons of soil based on a 20 cm thickness. Where the soil analysis report reveals the lime availability of 2.5% or less, "slightly limey or limeless" term is used. Accordingly, if a soil contains $250 \times 2.5\% = 6.25$ tons of lime, this soil is called as "slightly calcareous soil".

Based on the assumption that 20-40 kg calcium ammonium nitrate fertilizer is applied to 1 decare per year, the soil receives additional lime of 5-10 kg since the fertilizer contains 25% lime. A soil that is defined as "slightly calcareous" as it contains 6,250 kg of lime does not become lime-rich when 5-10 kg lime is added. Thus, the assumption that "*calcium ammonium nitrate fertilizer increases the soil lime content*" is completely groundless.

Moreover, it is known that 2-10 kg of calcium (Ca) is removed annually from soil per decare by cultivated plants. 2-10 kg calcium per decare occurs from the dissociation of 5-20 kg of lime (CaCO_3). Therefore, the calcium existing in the lime added to soil using calcium ammonium nitrate fertilizer is already removed from soil by plants at the same or slightly more quantity. If lime had easily dissolved and become calcium (Ca) or carbonate (CO_3), no lime would have remained in soil due to the precipitation in thousands of centuries.

Another wrongly information about calcium ammonium nitrate fertilizer is that it does not completely dissolve and remain on soil surface. As it has already been explained, lime and dolomitic lime do not dissolve easily in water and only these additives in calcium ammonium nitrate fertilizer remain on surface when applied on the soil surface and appear as a white layer. However, calcium ammonium nitrate fertilizer with either lime or dolomite contains NH_4NO_3 . So what is seen on the soil surface is only CaCO_3 or $\text{CaMg}(\text{CO}_3)_2$. It is necessary to extinguish the misinformation on calcium ammonium nitrate fertilizer and dolomitic ammonium nitrate fertilizer and to apply sufficient nitrogen required by plants in the forms of calcium ammonium nitrate or ammonium nitrate in top dressing according to results of soil analysis. It should be kept in mind that nitrogen is the most effective element for yield.

The best way to deliver nitrogen is the use of calcium ammonium nitrate and ammonium nitrate fertilizers.