

Why is Potassium Nitrate Such a Fantastic Fertilizer

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Potassium nitrate is an ideal fertilizer in the sense of it comprising the two nutrient-salts, potassium (K^+) and nitrate (NO_3^-), taken up in greatest amounts by the majority of plants and just about every crop grown. The nitrate - potassium combination per se holds the special advantage of increased potassium uptake efficiency due to the high root uptake affinity (uptake willingness) of nitrate and the need for plants to balance themselves by additionally taking up a cationic salt, potassium being an ideal candidate. Increased efficiency of potassium nitrate (KNO_3) means more potassium uptake for the amount of potassium supplied in using potassium nitrate as opposed to other potassium fertilizers for the supply of potassium.

Potassium nitrate holds specific benefits for potato growers worldwide. Our local South African researches have been instrumental in showing the benefits of potassium nitrate usage in potato specifically. From a grower view-point, potassium nitrate is a "quality" assurer. Potassium's role as a nutrient in the plant is unique in that it is solely involved in plant function regulation, potassium not being a structural component in any way. Most importantly, potassium regulates the movement of carbohydrates, organic acids, nutrients and other organic compounds into the tubers. Rapidly growing tubers require a high rate of carbohydrate movement from the leaves. The tubers themselves have a high need for potassium, higher than that of nitrogen - second highest in requirement - or any of the other essential mineral nutrients. The challenge is to ensure potassium sufficiency in the soil and plant before and during tuber filling, once the rapid period of tuber bulking has commenced. Potassium nitrate pivot applications in particular bolster plant potassium levels, and in this way increase size and improve harvest quality. Tuber visual appeal, carbohydrate content, size, and shelf life are all linked to potassium levels in the plant and tubers during growth and development period. The basis for these benefits is straightforward.

In potato, potassium nitrate applications are made through pivots a number of times at and after tuber initiation. 100 kg per ha is applied as many as four times prior to harvest. Calcium nitrate [$Ca(NO_3)_2$] applications may be alternated with potassium

nitrate pivot applications to maximize the benefits of both potassium and calcium feeding during the tuber formation phases. Calcium is often stated to be essential to ensure good finish, and potassium to ensure efficient transport of carbohydrates from leaf to tuber, the quantity transported influencing tuber size and starch content. Most soils utilized for potato growing are sandy. Nitrate is taken up readily and rapidly when applied if over watering is avoided to prevent leaching loss, nitrate acting to facilitate sufficiency of potassium and calcium uptake. As conversion of ammonium to nitrate in cool-sandy soils, in which most potato is grown, is less than ideal due to the relative lack of denitrifying

Nitrate is the preferred N source

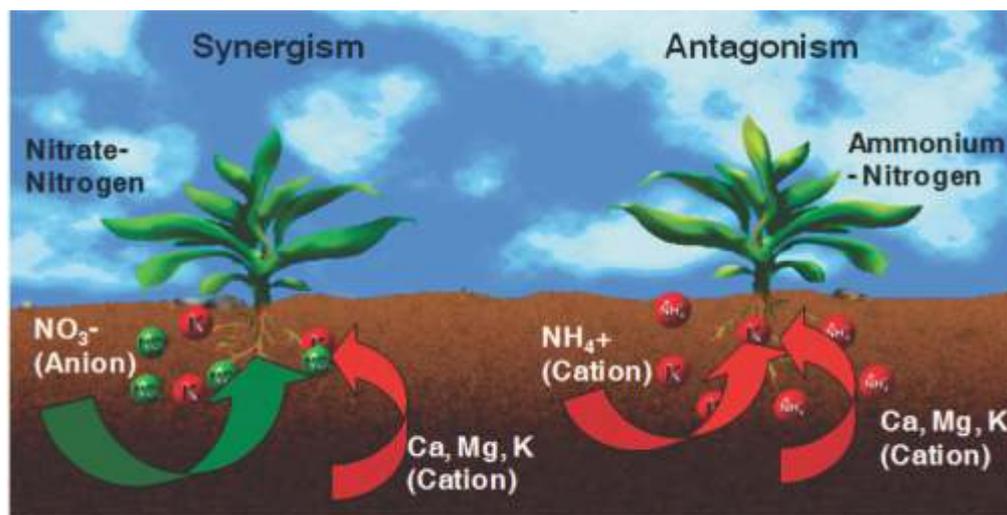


Fig. 1 As conversion of ammonium to nitrate in cool-sandy soils, in which most potato is grown, is less than ideal due to the relative lack of denitrifying bacteria, and ammonia uptake antagonizes the uptake of potassium and calcium, which are vital "quality" nutrients, ammonium sources of nitrogen should be largely avoided.

bacteria, and ammonia uptake antagonizes the uptake of potassium and calcium, which are vital "quality" nutrients, ammonium sources of nitrogen should be largely avoided (Fig. 1). Growers who apply potassium nitrate repetitively after tuber initiation attest not only to increased crop size and quality, but also to a greatly enhanced shelf-life.

Field trials confirm the benefits of nitrate nutrition in assuring efficiency and sufficiency of potassium and calcium uptake. Francois

Knight and his colleagues (1) found high nitrate as opposed to ammonium nutrition to be beneficial in a consideration of potato yield, a number of quality characteristics, and grower monetary return. Their study was carried out in the Sandveld of the Western Cape where low soil pH and the lack of clay and organic matter in the soils disfavour de-nitrification, the process of microbial conversion of ammonia to nitrate. Best results in terms of grower return were achieved when 80% of the required nitrogen was applied as nitrate. Research conducted by Bester and Maree (2) clearly showed the benefit of potassium nitrate as opposed to potassium chloride or potassium sulphate fertilization in potato. Nutrient quantities applied were equal. Potassium nitrate application gave rise to greatest tuber yield. Greater numbers and significantly larger tubers were produced by the potassium nitrate fed potato plants. The varieties used their study were BP1, Vanderplank, Up-to-date, and Pimpernell. In research work performed by Lourens and De Witt (3) on potato grown in sandy soil, highest yield was obtained when the required potassium was applied using potassium nitrate as opposed to the potassium sulphate or potassium chloride. This action resulted in the highest nitrate to ammonium ratio in the fertilization programme. Yield differences were ascribed to limited nitrification, differences in nitrogen uptake, toxic effects of excess ammonium, and enhanced nutrient uptake efficiency when potassium nitrate was applied. Sufficiency of potassium uptake by the tubers is vital to ensure size and quality. The tubers require twice the amount of potassium than the quantity nitrogen required, and six to seven times the amount of potassium than the quantity of phosphorus required.

The tubers themselves thus have an exceptional need for potassium. The high quantity of potassium required relative to nitrogen and the other macro- and major nutrients may be considered to emphasize the need a nitrate containing potassium source in fertilizing a potato crop once tuber development has been initiated. 

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