Importance of Nutrients in Onion Production

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Introduction

Onions represent the Second largest area and production among vegetable crops after Potato in India. The per capita consumption of onions is around 741 gram in the rural area and 854 gram in urban area per 30 days. They are a high-value crop, where both high yield and quality are important economic considerations. Successful onion production depends on careful nutrient management, as well as other management techniques, pest issues and climatic factors. An onion bulb is different from other root crops (such as sugar beets) or a stem-produced potato. Each onion layer is called a "scale" in botanical terminology and comprises of the foundation of an individual leaf. Hence, the number of leaves is important in determining bulb size. A premium price is paid for a large onion, so they are sorted and marketed according to size. The market place for smaller onions is limited and less valuable. Important quality factors for onions include bulb shape, scale, color, scale thickness, scale retention, number of scales, bulb firmness, number of growing points, paper quality and neck thickness.

Nitrogen Application

Nitrogen is the most major nutrients for high returns and bigger bulb size. High application rates of Nitrogen for Kharif onion 75 kg/ha and for Rabi Onion 110 kg/ ha a bare normally needed (It applied in 3 splits first at basal, second at 30 DAT and third At 45 DAT). Placement is more effective than broadcasting. Because the crop is shallow rooted with poor root branching, it is common practice to use split N-applications to maximize uptake efficiency. It is likewise significant to apply nitrogen in the right form to maximize uptake during specific periods of crop.

Deficiency symptoms

- Deficient crops are slow growing.
- Pale yellowish-green colored leaves.
- New leaves are thin, erect and smaller in diameter.
- They are also more prone to breaking.

Phosphorus application

Phosphorus is a constituent of nucleic acids (DNA and RNA) and essential for energy transfer inside the plant. Therefore, it causes a direct effect on production and quality. Phosphorus is rarely required in large quantities. However, where crops are grown on soils with very low natural P levels, higher rates are required to boost yield and bulb size. It is important that phosphorus is available early season in order to encourage growth, particularly of the root system. Placement of phosphorus within the root zone has been shown to work better than when P-fertilizer is broadcast.

Deficiency symptoms

- Plant growth and establishment slows and rooting is adversely affected and stunted.
- Leaves are mottled green/yellow, brown.

- Maturity can also be delayed and crops tend to have a thicker neck at harvest.

Potassium application

Potassium is required in the production and transfer of sugars and carbohydrates to the bulb, enzyme activation and synthesis of proteins. It also maintains the ionic balance and water status within the plant, thereby improving resistance to cold injury and drought. Onions have a relatively high K-requirement. Maximum uptake is later than that of nitrogen and peaks during bulb formation and enlargement. However, over-application can lead to yield reductions.

Deficiencies symptoms

- Leaf tips turn brown and there is some slight yellowing of older leaves.
- Growth slows and leaves become erect.
- The entire leaf may also droop and appear thin and papery.
- Bulbs are soft with thin skins.

Boron application

Boron is involved with carbohydrate metabolism and protein synthesis. It also plays a key role in calcium movement within the plant. Boron is one of the essential micronutrients for onion production and should not be confined. While is quickly carried up from the soil, it is relatively immobile in the plant, so foliar sprays are much more efficient. It is important to sustain the right balance of calcium, nitrogen and boron in the soil. High calcium and high nitrogen levels can reduce boron uptake.

Deficiencies symptoms

- Young leaves develop yellow and green mottling.
- Older leaves yellow and die back.
- Light yellow lines appear and develop into ladder-like transverse cracks on the upper surfaces of older leaves.
- They become brittle and deep green in color.

Table1. Effects of Micro Nutrients at Growth Stages

Macro nutrients			
Stage	**Nitrogen**	**Phosphorus**	**Potassium**
Pre-Planting	Promote strong early growth	Maximize root development and to supply reserves for season long growth and good building	Promote strong early growth
Vegetative Growth	Ensure continued growth and development	–	Ensure continued growth and development
Bulb Formation	In nitrate forms to maintain bulb development and early growth		Peak requirements are during bulbing – for yield and quality
Bulb Fill	In reduced amounts so as to maintain dry matter production, but not compromise bulb quality	Encourage ripening, early maturity and a big bulb size	Maximize dry matter & sugar accumulation as well as quality

- Plants can be stunted or distorted.
- Deficiencies are most common on low pH and sandy soils as it is readily leached.

Zinc application

Zinc is important for the development and function of growth regulators (e.g. Auxins) that influence Internode elongation. It is also involved in chloroplast development and thus important for photosynthesis. Zinc uptake can be limited by heavy application of Phosphorus. Therefore, it is important that zinc and phosphorus are balanced, particularly during the early phases of growth.

Deficiencies symptoms

- Deficient plants are stunted and have twisted, outward bending leaves.
- Older leaves take on an orange mottled appearance.
- Younger leaves have a faint chlorosis and yellow striping.
- Building can be delayed and crops may not store well.
- Problems are more common on high pH or calcareous soils or during cold, wet weather.

Calcium application

Calcium is a key component of cells, maintaining the structure of cell walls and stabilizing cell membranes. It likewise delivers a direct influence on the salt balance within plant cells and activates potassium to regulate the opening and closing of stomata to allow water movement from the plant. Calcium enhances pollen germination regulates some enzyme systems and acts upon the maturation and health of cells and conductive tissues. Calcium is probably the third most important nutrient needed by onions and has a central character to play in maintaining crop quality. Calcium nitrate is particularly useful applied early to improve establishment, ensuring crops are ready to make a desired height before transplanting. Although relatively low levels of calcium in the bulbs are critical for storage and quality, improving the strength of the cells.

Deficiency symptoms

- Leaf tips or short lengths of the leaf - die back, without any previous yellowing of the leaf, causing the top of the leaf to fall over and die.
- Onion bulbs are of low density and reduced quality and have softer skins.

Magnesium application

Magnesium is required for many processes including transfer of energy and protein synthesis. With 20-25% of the plant's total magnesium localized in the chloroplasts, it is especially important for chlorophyll production. Onion crops use relatively low levels of magnesium. However, a regular supply needs throughout the life of the crop. Special caution is needed in fertization systems to ensure that magnesium, potassium and calcium are balanced.

Deficiency symptoms

Older leaves turn a uniform yellow along with their entire length due to lack of chlorophyll.

Leaves can exhibit pale lesions on leaf tips.

Sulfur application

Sulfur is an important component of enzymes and other proteins and is required for chlorophyll formation. It has a marked effect on the pungency of the onion through increasing the pyruvic acid content of the bulb a key quality characteristic. Most sulfur uptake occurs in late season during bulb growth. Sulfur helps to improve the crop's utilization of nitrogen. Plants with high sulfur content have greater tolerance to pest and disease attack. Sulfur has also been linked to increased skin

strength and color.

Deficiency symptoms

- Leaf production is affected and the plant produces fewer leaves.
- Younger leaves are uniformly yellow in color.

Molybdenum application

Molybdenum is an important component of nitrate reductase and thus involved in nitrogen metabolism as well as the synthesis of pigments and chlorophyll. As all other micronutrients, molybdenum plays a role in seedling and leaf growth.

Deficiency symptoms

- Deficiency in new crops results in poor crop emergence and seedling death.
- In established crops, lack of molybdenum leads to leaf tip dieback with wilted tissue between the necrotic and healthy areas.
- Problems are most common on acidic or sandy soils with low organic matters.

Copper application

Copper has a key role to play in lightning formation. It is also linked to chlorophyll performance. Adequate supplies of copper are important for bulb skin and onion scale development, as a result of the element's role in learning production.

Deficiency symptoms

- Tips of young leave turn white and twist into a corkscrew or bend at right angles.
- Bulbs have thin, yellow outer scales are less solid and are often earlier maturing.
- Deficiencies are more common on organic or sandy soils and where excessive nitrogen rates have been applied.

Table 2. Effects of some Micronutrients in Onion

Stage	Boron	Zinc	Calcium
Pre-Planting	Ensure good shoot growth	Ensure good shoot growth	
Vegetative Growth	Ensure photosynthetic growth is not limited	Ensure photosynthetic growth is not limited	Maintain vigorous, healthy leaf growth and to build plant supplies prior to building
Bulb Formation	To maintain leaf growth	To maintain leaf growth	Ensure good supply to the bulb to maximize eventual storage quality
Bulb Fill	To improve storage quality and calcium uptake	Less critical, but to maintain growth and prolong bulking	Maintain good bulb firmness and quality with reduced storage problems

Table3. Effects of Micronutrients in Onion

Stage	Magnesium	Copper	Molybdenum	Sulfur
Pre-Planting				Encourage plant growth

Stage	Magnesium	Copper	Molybdenum	Sulfur
Vegetative Growth	Maintain vigorous, healthy leaf growth and to build plant supplies prior to building	Ensure photosynthetic growth is not limited	Ensure photosynthetic growth is not limited	
Bulb Formation		To maintain leaf growth	To maintain leaf growth	
Bulb Fill		For good skin quality	Less critical, but to maintain growth and prolong bulking	Depending upon the desired pungency of the onion

Conclusion

Nutrients is very important for quality production and it is also responsible to increase the storage life of product. Major and minor nutrients are important in physiological and biochemical reactions, they are useful for the manufacture of sugars and carbohydrates. Minor nutrients are essential for pollen germination, amino acid, enzyme, chlorophyll, anthocyanin, etc. A good nutrient management in onion ensure bumper quality production.

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