



# Nitrogen

## The “Superstar” in Crop Nutrition

Nitrogen (N) is the “flagship nutrient” of most soil nutrient programs. It is often described as the single most important factor limiting crop growth. Nitrogen is necessary for all forms of plant and animal life. It is required by most plants in amounts greater than any other essential element. The average corn crop will remove more than 6 billion pounds of N from the soil every year. A shortage of nitrogen is visible by slow growing plants that are yellow and produce low yields and quality.

### Why is nitrogen important?

Some of the benefits that nitrogen provides in growing plants are:

- Formation of amino acids and protein
- Synthesis of chlorophyll
- Component of coenzymes and chlorophyll
- Improved seed formation
- Improved seedling vigor and early growth

### What nutrients do crops need?

Nitrogen is essential for growth of all crops. This includes the symbiotic fixation of nitrogen by legumes. Nitrogen is needed throughout the life cycle of a crop such as corn. Crop need for nitrogen increases with improvements in crop yield and/or quality (protein in wheat). Nitrogen use efficiency can be improved by ensuring that sulfur and potassium are not limiting crop growth. These three nutrients are a team that is essential for protein formation, photosynthesis, and other vital plant growth conditions. Since soil testing for nitrogen has limited success, nitrogen needs are usually determined based on yield goal times a removal coefficient for each crop.

#### Nutrient uptake by major crops

Crop	# N	# P <sub>2</sub> O <sub>5</sub>	# K <sub>2</sub> O	# S	# Mg
Corn (180 bu/a)	240	100	240	28	41
Soybeans (60bu/a)	325*	65	140	25	26
Bermudagrass (8t/a)	370	96	400	44	26
Wheat (55bu/a)	120	45	85	13	15
Rice (7500#/a)	120	60	170	12	15
Cotton (1500#/a)	180	65	155	40	32
Alfalfa (8t/a)	410*	95	400	40	40

\* Legumes get most of their N from the air.

### When does the corn plant need nitrogen?

A 180-bushel corn crop requires about 240 pounds of nitrogen during the growing season. High yields require a steady supply of nitrogen from rapid growth prior to silking until grain fill is complete. Peak uptake occurs just prior to silk emergence. Nutrient requirements are expected to advance as yields are improved due, in part, to genetic improvements in seed.

#### Nitrogen usage by 180-bushel corn crop

Days	% of total use	Total %
0-25	8	8
26-50	35	43
51-75	31	74
76-100	20	94
101-125	6	100



## Nitrogen deficiency in high yield crop production

Deficiency symptoms:

- Yellowing along the midrib of older leaves of corn
- Stunted early season growth of grass crops
- Low protein levels in corn and wheat grains
- Reduced fall and spring tiller development in wheat
- Low protein and feed value of forage crops

## Importance of balanced nutrition

Proper nitrogen management has received the most attention in crop nutrition, but it should be noted that both sulfur and potassium are important in getting the most out of an investment in N fertilizer. Data from Oklahoma show how N, P, and K interacted to increase wheat yields and N use efficiency. Analysis of the data shows that P was the most limiting of the three nutrients, but it took both P and K with nitrogen to achieve optimum yields.

### Nitrogen, phosphorus and potassium interact to increase wheat yields and improve nitrogen use efficiency

Treatment lb/A	Treatment lb/A			Grain yield, bu/A	N Efficiency bu/lb
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O		
0	0	0	0	29	—
100	0	0	0	24	0.24
100	120	0	0	45	0.45
100	0	120	0	26	0.26
100	120	120	0	52	0.52

Oklahoma

## Impact of nitrogen levels on yield and quality

Adequate nitrogen is necessary for high crop yield and optimum plant use of potassium, sulfur and other essential production inputs. Corn adequately fertilized with N will have lower moisture content in the grain at harvest. Higher plant populations have been shown to require more nitrogen to increase yield and N use efficiency. Also, proper balance of applied nutrients can influence market acceptance for crops like tomatoes, peppers or other fruit and vegetable crops.

## Nitrogen and potassium influence on tomato yield and marketability

K <sub>2</sub> O (lbs/a)	Nitrogen (lbs/a)		
	120 tomato yield	175 tons/acre (%)	240
0	7.1 (41)	7.6 (56)	9.4 (55)
300*	15.2 (71)	15.6 (76)	16.1 (77)
300**	17.4 (80)	21.0 (85)	26.8 (85)

\*applied preplant \*\* applied ½ preplant and ½ sidedress  
(%) of total yield that is marketable Source: IPNI

## Nitrogen Nutrient Management

Nitrogen is very mobile in the soil so proper management is critical to supply the crop with its needs while minimizing its loss to the environment from leaching, denitrification or volatilization. Effective N management includes proper N form, rate, placement and timing. It is preferred to supply the nitrogen throughout the season as crop usage dictates. Site-specific N management and high-yield systems insure increased N utilization while reducing potential N loss to ground and surface waters.

