



Nitrogen Fertilization SITE-SPECIFIC

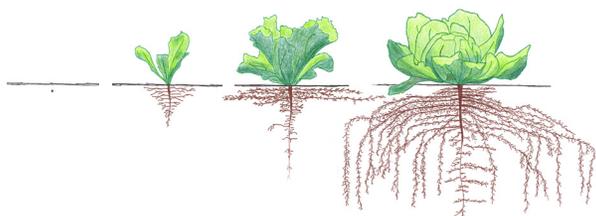
Taking Non-Fertilizer N Into Account

Non-fertilizer N sources need to be taken into account when planning N application rates. In addition to residual soil nitrate, nitrate in the irrigation water should be accounted for to reduce the amount of N fertilizer applied. Nitrogen mineralization from soil organic matter and crop residues also add available soil N. Net N mineralization is generally higher after broccoli or cauliflower than after lettuce. These factors are taken into account by CropManage, a web-based irrigation and N management software tool developed by Cahn and coworkers. CropManage can be accessed here:

<https://ucanr.edu/cropmanage/login/>

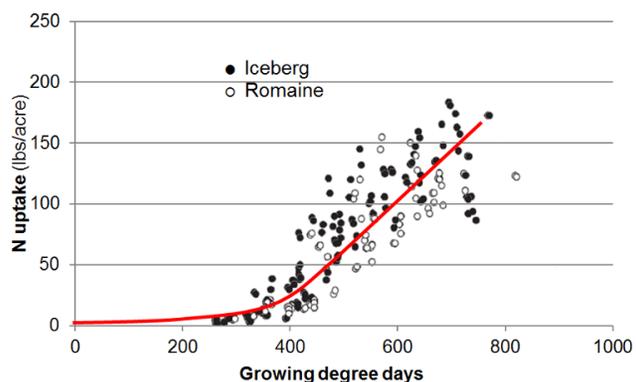
Soil Sampling

Soil samples for nitrate analysis can be sent to a laboratory or extracted and analyzed on the farm. The soil nitrate quick test with colorimetric test strips is highly correlated with the standard laboratory technique and has been found to be a reliable estimate of current soil N status. Although the quick test is less accurate than a standard laboratory analysis, its accuracy is generally sufficient for routine on-farm use when done correctly. With the quick test, soil nitrate can be determined in a timely manner in order to make N fertilization decisions.



Lettuce Nitrogen Uptake and Partitioning

Seasonal N Uptake



Information regarding lettuce fertility management, including placement, fertilizer source, phosphorus and potassium are available at:

<http://apps.cdafa.ca.gov/frep/docs/guidelines.html>



SELECTED REFERENCES

Bottoms, T.G., Smith, R.F., Cahn, M.D., Hartz, T.K., 2012. Nitrogen requirements and N status determination of lettuce. *HortScience* 47, 1768-1774.

Hartz, T.K. et al. The value of presidedress soil nitrate testing as a nitrogen management tool in irrigated vegetable production. *HortScience* 35, 651-656.

Hartz, T., Smith, R., 2012. In-season soil nitrate testing explained. UCCE Monterey County Crop Notes July/August, 2012.

Smith, R., 2010. Fine tuning nitrogen management for vegetable production. UCCE Monterey County Crop Notes March/April 2010.



LETTUCE NITROGEN Fertilization Guidelines

Online nutrient guidelines for lettuce and other crops, as well as relevant references, are available at:

apps.cdafa.ca.gov/frep/docs/guidelines.html

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Daniel Geisseler and William R. Horwath, Department of Land, Air and Water Resources, UC Davis, gathered and organized the guideline information through FREP research contract 11-0485.



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Nitrogen Fertilization at PREPLANT or SEEDING

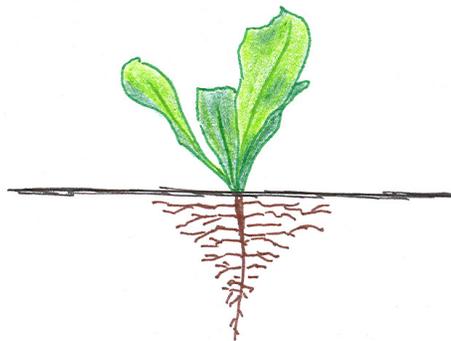
Application Rates

Preplant and starter application rates depend on residual soil nitrate-N. When the residual nitrate-N concentration exceeds 20 ppm, no N application is required. When the residual soil nitrate-N concentration is lower, a small application of 20-40 lbs. N/acre just before or at planting is sufficient to cover the early N needs. To ensure that N is available in the root zone of young plants, the irrigation management needs to be optimized to prevent nitrate movement below the root zone.

Application Timing

Pre-plant N applied in fall at bed listing is highly susceptible to leaching below the root zone by winter rain. Lettuce receiving starter and sidedress N generally outperforms lettuce that received a broadcast N application before seedbed preparation.

The starter fertilizer band is generally placed two inches below and two inches to the side of the seed row.



Nitrogen Fertilization during ROSETTE STAGE and HEAD DEVELOPMENT

Between heading and harvest, N demand of lettuce is high, reaching 3-4 lbs. N/acre per day. During this period, which is generally the last month before harvest, 70-80% of total N is taken up. A sufficient N supply between heading and harvest is crucial for obtaining a high yield.

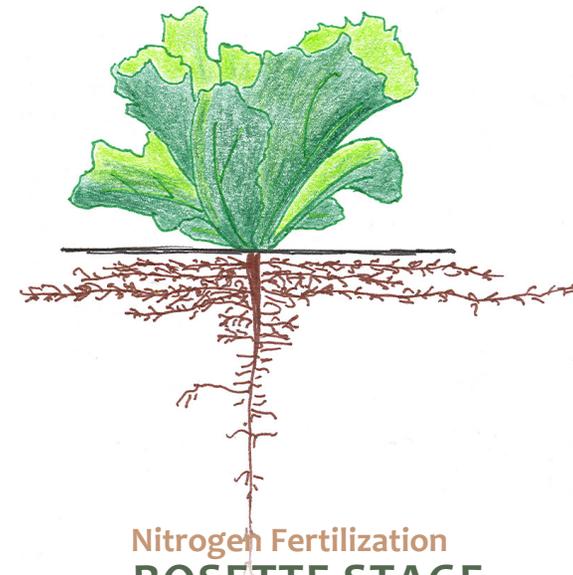
Application Rates

When leaching losses are minimized, the seasonal N application rates for lettuce should not exceed 150-180 lbs./acre for winter and spring production and 100-140 lbs./acre for summer and fall production. However, the required N rate depends on the residual soil nitrate content. Crops produced from late fall through early spring generally require more fertilizer N because the residual soil N content tends to be lower during this period compared to the summer months.

If the soil nitrate-N concentration is below 20 ppm, only enough N to increase soil available nitrate-N to 20 ppm is needed. Approximately 4 lbs. N/acre needs to be added to increase the soil nitrate level by 1 ppm. As an example, when the soil nitrate-N concentration is 15 ppm, 20 lbs. N/acre (4 lbs. x 5 ppm) are needed to increase the level to 20 ppm. This approach has been successfully used in iceberg and romaine lettuce.

Mode of Application

Sidedress N should be applied at a distance of at least 2-3 inches from the plant to avoid root damage from high salt concentrations in the band. Even at this distance, root burn of young lettuce plants has been observed in soils with a high clay content.



Nitrogen Fertilization during ROSETTE STAGE and HEAD DEVELOPMENT (continued)

Application Timing

When the pre-sidedress soil nitrate-N concentration is below 20 ppm, the first sidedress N application is done after thinning at the two- to four-leaf stage. If the residual nitrate-N concentration drops below 20 ppm, a second application is done 2-4 weeks later at the cupping stage. Some growers apply 10-15 lbs. N/acre 7 to 10 days prior to harvest to assure that the crop color and growth rate are optimal. The decision whether to apply late-season N should also depend on the residual nitrate-N level.

Leaf Analysis

A minimum of the 20 youngest wrapper leaves should be collected, each from a different healthy plant of representative vigor. Samples are taken from the entire field. Variable fields should be divided into uniform blocks, which are sampled separately. It is important to accurately determine the crop growth stage, since the total N concentration declines as crops develop. Once tissue samples are collected, they should be dried as quickly as possible. Hartz and coworkers developed optimum leaf nutrient ranges for iceberg and romaine lettuce based on a survey (see table). The optimum nutrient concentrations can be considered sufficient for high-yield production. As the values were obtained from fields with generally high N and P inputs, values below the optimum range for these two nutrients may not limit yield.

Optimum N, P & K Concentrations of Whole Leaf Samples

Sampling Date	Nutrient Concentrations (%)		
	N	P	K
Early Heading	4.3-5.6	0.45-0.75	3.3-6.4
Pre-harvest	3.3-4.8	0.35-0.75	2.9-7.8

For more references and information about N management in lettuce, please access:

<http://apps.cdffa.ca.gov/frep/docs/guidelines.html>

