

Lettuce

The level of nitrogen fertility probably has more influence on the growth and yield of lettuce than other plant nutrients because it is the nutrient most often deficient in Arizona soils. With good management, a total of about 175 to 200 lbs. N per acre is needed for optimum production using normal furrow irrigation practices. Leaf midrib analysis during the season can be very useful in monitoring the nitrogen status of the crop. Deficiencies of nitrogen at any time in the season are to be avoided, as yields will usually be reduced or maturity delayed. Deficiencies after the initiation of head formation, called “folding”, are especially serious because the size of lettuce heads will be reduced. Applications of nitrogen after the heads have attained full size may result in greener plants but will not affect head size or yields, except perhaps on very sandy soils.

Fertilizer recommendations in this guide apply to all adapted head lettuce varieties and are based on plant populations ranging from 20,000 to 26,000 plants per acre (typically, two rows per 40 inch bed and 12 inch spacing). Significantly different plant populations or non-heading cultivars may require somewhat different fertilizer rates.

- **Early season nitrogen**

Preplant applications of nitrogen are normally very inefficient due to leaching of soluble nitrates that will occur when irrigation water is applied during germination and stand establishment. In addition, preplant applications exceeding 50 to 60 lbs. of ammonium-N per acre have been shown to result in stand loss and stunting of newly germinated seedlings in directly-seeded fields. Nitrogen utilization can be improved by making the first application as a side-dressing or injecting solution fertilizers into the prethinning irrigation. A total of 50 lbs. N per acre can be applied between stand establishment and thinning to provide adequate N nutrition.

- **Mid-season nitrogen**

At the four- to six-leaf stage of growth, collection of leaf midrib samples for nitrate ($\text{NO}_3\text{-N}$) analysis should begin. The thick midrib from the center of the youngest full-sized leaves should be separated from the leaf blade (Figure 46). Do not sample midribs from diseased, damaged or unrepresenta-



Figure 46.

Begin sampling lettuce midribs at the 4- to 6-leaf stage. Collect the midribs from the youngest full-sized leaves as shown above.

tive leaves. On older plants, sample midribs from the youngest full-sized wrapper leaves. These are typically the “easiest” leaves to sample. About 25 to 50 midribs per sample are adequate for analysis, depending upon the size of the leaves at the time of collection. The number of samples tested from each field depends on the uniformity of the field. Samples should be collected from randomly selected plants within uniform areas representing portions of a field that can be fertilized separately. Samples should be taken at one- to two-week intervals through heading. Samples should be placed in a paper bag and dried at about 150° F or refrigerated as soon as possible and submitted to a laboratory for $\text{NO}_3\text{-N}$ analysis.

- **Interpretation of midrib nitrate levels**

The midrib nitrate levels should be maintained at a level about 8,000 to 10,000 ppm $\text{NO}_3\text{-N}$ throughout the growing season (Figure 47). The higher levels are recommended for crops that will form heads during cold periods when the average weekly air temperatures drop below 55° F.

Most N is sidedressed just prior to an irrigation or injected into the irrigation water. For this reason it is suggested that midrib samples be obtained well before an irrigation event so that laboratory results will be available to guide individual mid-season N applications as shown in the Table 43.

A timely application of N fertilizer can prevent or slow the decline of midrib nitrate. If the nitrate-N level is below 6,000 ppm prior to the “folding”

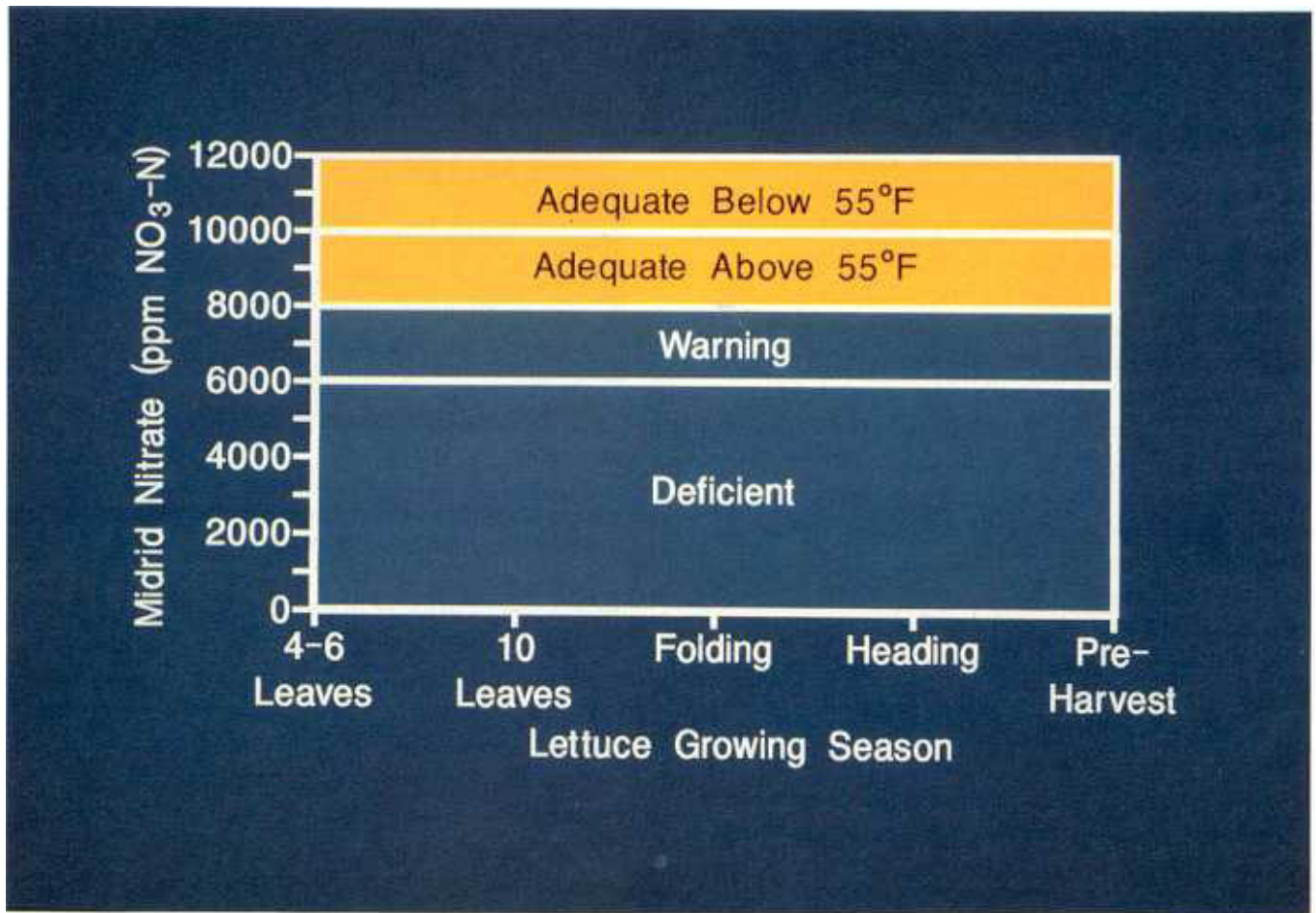


Figure 47. Interpretation of lettuce midrib NO₃-N levels at different stages of growth and average weekly air temperatures.

Table 43. Recommended nitrogen fertilizer application rates based on midrib NO₃-N levels. These N rates are for individual N applications made from the 4 to 6 leaf stage through heading.

Midrib NO ₃ -N	Apply this amount of N ¹
ppm	lbs/acre
above 10,000	None
6,000 to 10,000	30 to 60
3,000 to 6,000	60 to 80
below 3,000	80 to 100

¹Use the higher recommendations if heading occurs during periods of below 55° F average weekly air temperature.

stage, then application of a nitrate or urea source is recommended. These forms of N move readily in soil solution and are immediately available to the plant roots with the first irrigation after the fertilizer has been applied. This decreases the time necessary for recovery from a nitrogen deficiency. At higher levels of midrib nitrate, the nitrogen source is of less importance because nitrification of ammonium (NH₄) sources can take place rapidly enough to permit the resulting NO₃ to be moved into the root zone to supply the needs of the plants. Caution should be used when applying ammonium sources of nitrogen such as anhydrous or aqua ammonia in order to avoid plant injury from ammonia toxicity, especially on very sandy soils.

NOTE: Nutrient uptake and plant growth almost stop when the soil temperature at 6 inches deep is below 45° F or the average weekly air temperature is below 55° F. Applications of water and/or nitrogen in any form cannot compensate for temperatures below these levels. In fact, unnecessary irrigations can further reduce soil temperatures and decrease oxygen content in the root zone to harmfully low levels. Local weather information can be obtained from the National Weather Service or through Cooperative Extension's Arizona Meteorological Network (AZMET). The local County Extension agent can provide further details on how to access AZMET.

- **Nutrient removal**

A harvest of 800, twenty-four count cartons of head lettuce per acre contains about 50 lbs. N. The entire crop will contain between 100 to 125 lbs. N per acre.

- **Nitrogen uptake patterns**

Nitrogen uptake proceeds very slowly in lettuce until the crop enters the folding stage. Then N flux increases to about 3 lbs. per acre per day during heading for winter-grown crops. Higher N fluxes of shorter duration would be expected for fall- or spring-grown crops which mature more rapidly. Head lettuce generally takes up about 80% of its total N during the last four weeks prior to harvest.

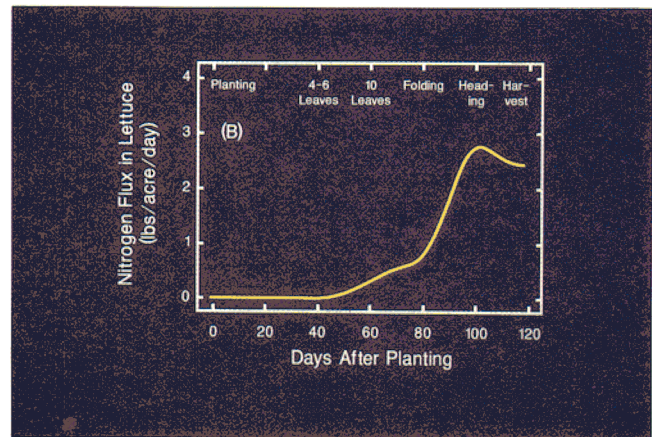
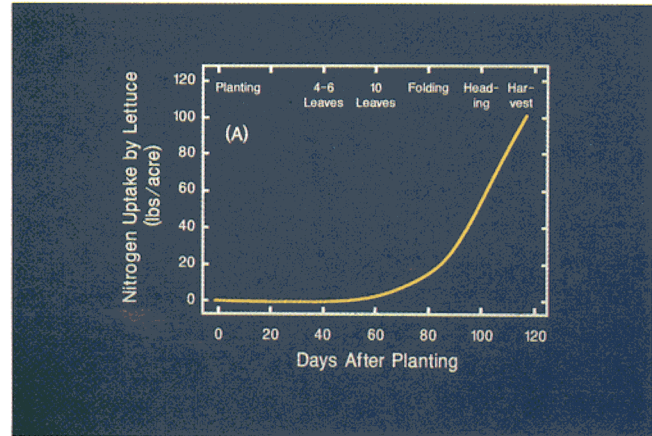


Figure 48. Cumulative seasonal nitrogen uptake (A) and daily nitrogen flux (B) patterns for winter-planted Climax head lettuce at a yield level of 690 cartons per acre.