Potatoes

The level of nitrogen fertility has more influence on the growth, yield and quality of potatoes than any other single plant nutrient because it is the nutrient most often deficient in Arizona soils. With good management, a total of about 150 to 200 lbs. N per acre is usually needed for optimum production. Preplant soil analysis and leaf petiole analysis during the season can be useful in monitoring the N status of the crop.

Proper irrigation management is particularly important in obtaining high yields of good quality tubers. An adequate supply of N from planting through tuber development is required, although excessive rates of N can reduce tuber quality, delay maturity and add to production costs.

The actual amount of N fertilizer that is required depends on the preceding crop, the amount of residual N remaining in the soil from the preceding crop and the likelihood of leaching losses due to over-irrigation.

Fertilizer recommendations in this guide apply to all potato varieties grown in Arizona and are based on a yield potential of 10 to 20 tons per acre. Rates may need to be adjusted for significantly different yield goals.

- **Estimating crop N requirement**

Use either Table 46 or Table 47 to estimate the fertilizer N requirement for potato production.

- **Early season nitrogen**

Up to 60 lbs. N per acre should be applied before or at planting. Nitrogen can be broadcast on the surface and incorporated or placed in a band two inches below and two inches to the side of the seed piece. Placement of N along with phosphorus fertilizers in this band configuration is probably the most efficient method of preplant nutrient application. Urea (46-0-0) or diammonium phosphate (18-46-0) forms of N may cause seedling injury if banded close to the seed, especially on sandy soils.

- **Mid-season nitrogen**

All remaining N should be sidedressed or applied in the irrigation water between the 6- to 8-leaf stage and mid-season. Periodic sampling of leaf petiole tissue during the growing season for NO_3-N analysis can be useful in monitoring the N status of the crop.

Table 46.
Estimated seasonal nitrogen fertilizer rates for potatoes based on preplant soil NO_3-N levels. These guidelines have not been verified for potatoes grown in Arizona.

NO_3-N Soil Test Level	Apply this Amount of N
ppm	lbs./acre
0 - 10	150 - 200
10 - 20	100 - 150
20 - 50	100 - 100
above 50	50

Table 47.
Estimated seasonal nitrogen fertilizer rates for potatoes based on the preceding crop. These guidelines have not been verified for potatoes grown in Arizona.

Previous Crop	Apply this Amount of N
	lbs./acre
Small grain* or non-legume hay	150 - 200
Row crops	120 - 150
Alfalfa	100 - 140

**Some additional N may be required if grain straw or non-legume residue is incorporated after October 1.*

Petioles (leaf stem) from the youngest full-sized leaves should be sampled. This is normally the fourth or fifth leaf from the terminal of the vine (Figure 51). Do not sample petioles from diseased, damaged or unrepresentative leaves. All leaflets should be stripped off the petiole immediately after sampling. About 25 to 50 petioles per sample are adequate for analysis. 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 placed in a paper bag and dried at about 150°F (65°C) or refrigerated as soon as possible and submitted to a laboratory for NO_3-N analysis.

Use Table 48 and Figure 52 as guides to interpret potato petiole nitrate levels throughout the growing season.

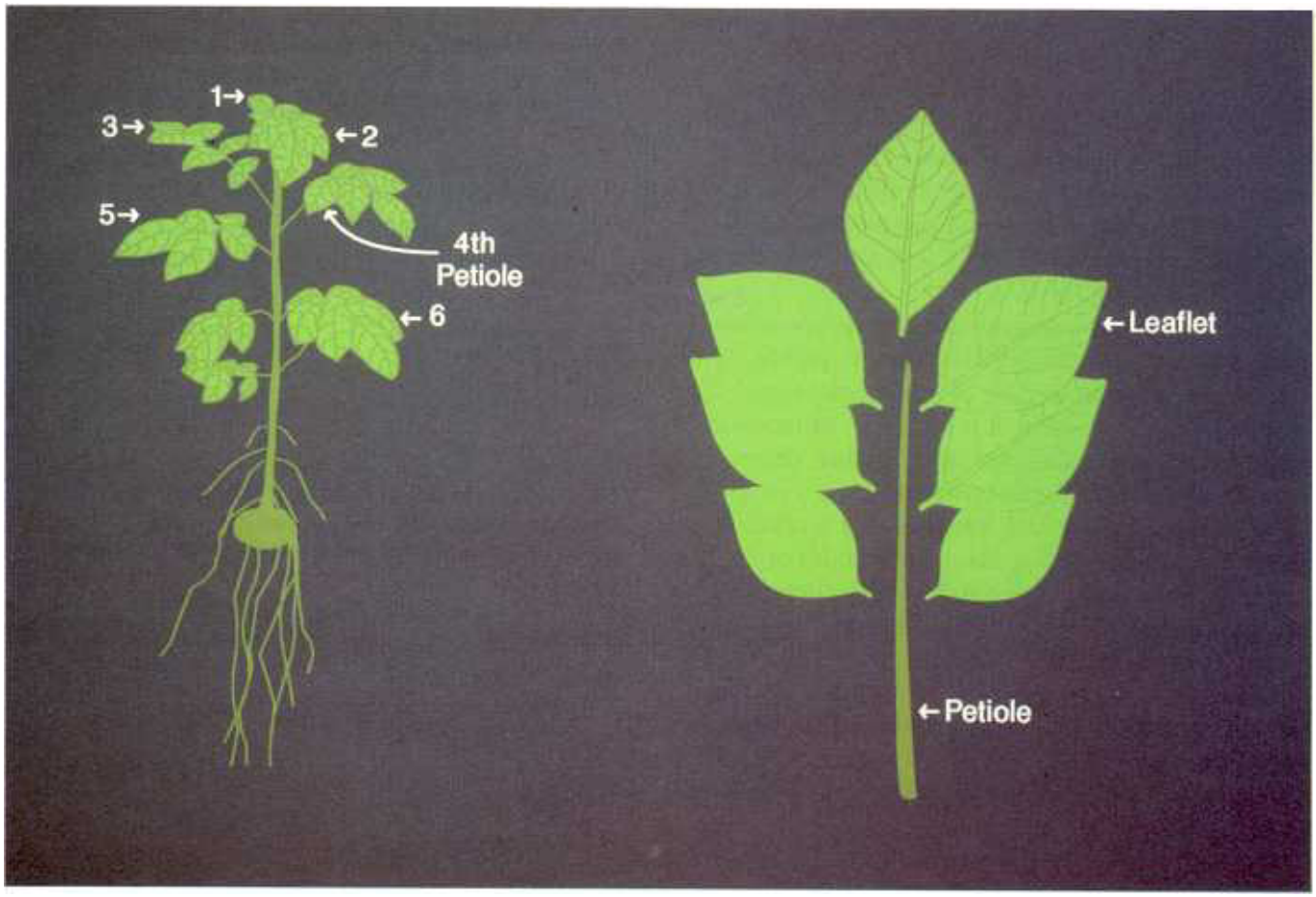

Figure 51.
Diagram of a potato plant at the 6- to 8-leaf stage when petiole sampling should begin (left). Remove all leaflets from the petiole immediately after sampling (right) (after Kleinkopf et al. 1984. Tissue Analysis: A Guide to Nitrogen Fertilization for Russet Burbank Potatoes. CIS No. 743, University of Idaho).

Table 48.
Interpretation of nitrate-nitrogen levels in potato petioles at various stages of growth. These guidelines have not been verified for potatoes grown in Arizona.

Stage of Potato Growth	Petiole NO_3-N Interpretations		
	Deficient	Intermediate	Sufficient
	ppm		
6- to 8-leaves, stolons forming	<16,000	16,000 - 22,000	>22,000
Tuber initiation	<10,000	10,000 - 15,000	>15,000
Tuber growth	< 8,000	8,000 - 15,000	>15,000
Late season	< 4,000	4,000 - 10,000	>10,000

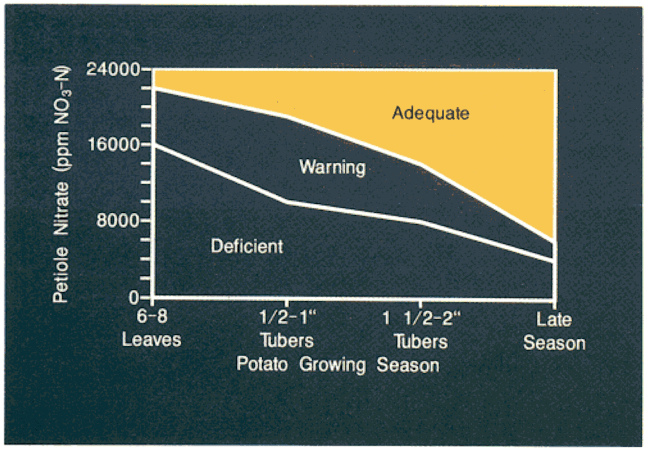

Figure 52.
Interpretation of NO_3-N levels in potato petioles at different stages of growth.

If a nitrogen deficiency is detected at any time through the 2-inch tuber stage, then an 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 the nitrogen deficiency. Otherwise, the N source is of less importance because nitrification of ammonium (NH_4) forms can take place rapidly enough to permit the resulting NO_3 to be moved into the root zone to supply the needs of the crop. 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.

- **Nutrient removal**

A harvest of 15 tons of potatoes per acre will contain about 100 lbs. N. The entire crop will contain about 200 lbs. N per acre.

- **Nitrogen uptake patterns**

Nitrogen uptake by potatoes is very low during the first 40 to 50 days after planting. As the stolons and vines become fully grown and tubers begin to enlarge, N flux reaches a maximum of more than 6 lbs. per acre per day. After tubers have reached their full size and vine senescence begins, N flux drops rapidly. An actual net loss of N from the whole plant prior to harvest probably does not occur. Negative N fluxes at this time probably reflect incomplete recovery of dead foliage as the plant completes its life cycle.

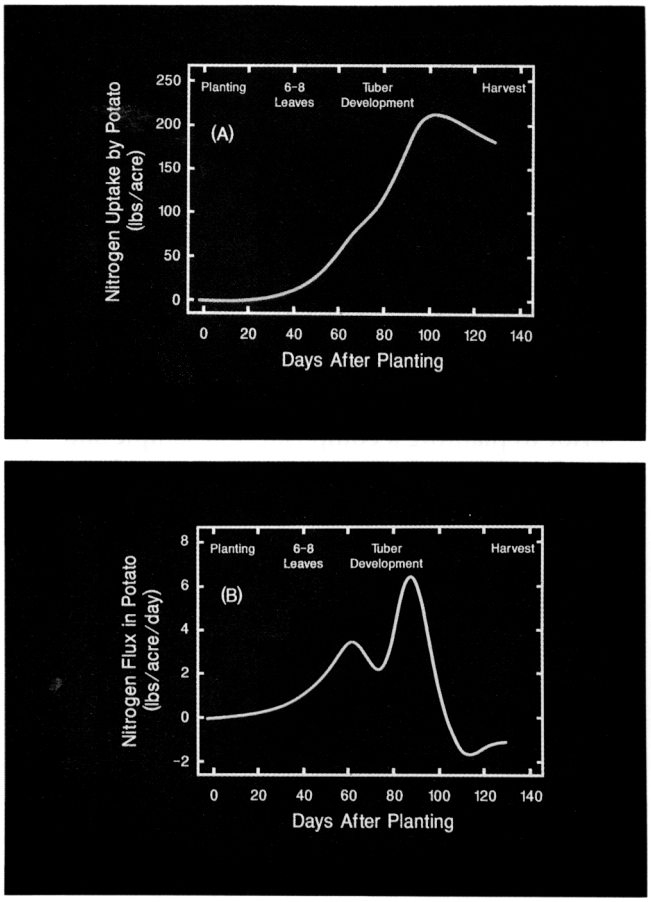

Figure 53.
Cumulative seasonal nitrogen uptake (A) and daily nitrogen flux (B) patterns for Kennebec potatoes at a yield level of 12 tons per acre.