

TIMING OF NUTRIENTS FOR MAXIMUM EFFICIENCY

Timing: Early Season

Critical Elements

Nitrogen (N)

Key Physiological Roles/comments

Early shoot and vegetative growth, overall flower bud development and vigor; "Breaking" dormancy, pre-bloom, flowering and early crop growth for perennial crops. For fast growing annuals, N is especially critical shortly after planing or transplanting for early growth and vigor. Early nitrogen applications aid in the absorption or utilization of secondary and micronutrients.

**Zinc (Zn), Manganese (Mn), Iron (Fe),
Copper (Cu), Calcium (Ca), and Boron (B)**

Calcium and the transition series metals (Zn, Mn, Fe and Cu) are most easily absorbed and translocated by young leaves of plants that have not yet developed heavy waxy cuticles on their surface. Zn promotes the formation of natural growth hormones (auxins) that function in cell elongation processes, and helps to strengthen internodes and expand leaves. Mn aids in chlorophyll synthesis and thus is essential for production of carbohydrates (sugar). Fe is also required for photosynthesis and is also used in plant respiration and improves flowering and set. Movement of Fe is inhibited by cold, wet weather. Cu is critical to photosynthesis and aids in the development of pigments. B can aid the absorption and translocation of Ca and is required for cell division and differentiation, for shoot and root tip (meristem) growth, flower and bud formation, pollen tube growth and pollen viability, and fruit set. Ca is fundamental to cell wall integrity and structure. Thus, Ca plays a key role in crop firmness and resistance to cellular breakdown disorders.

**Timing: Early-Mid Season
(4-6 weeks post-bloom)
Critical Elements**

Potassium (K)

Key Physiological Roles/Comments

As rapid growth commences, fruit or crop becomes a "sink" for K; increasing amounts become necessary to form carbohydrates-sugars and starches. K is also required for continual protein synthesis, proper maintenance of water relationships, and the production of certain organic acids. K is a crop maturation element, tends to increase leaf and fruit size, promote root growth, favorably effect fruit color and quality (if not out of balance with Ca). K can lead to increased disease resistance in grain crops.

**Timing: Later-Mid Season
(6+ weeks post-bloom)
Calcium (Ca), Magnesium (Mg)**

Although Ca is not regarded as being "mobile" during applications at this time or later, its application from here to harvest is essential for quality enhancement, eg. reduction in bitter pit, corkspot and alfalfa greening in apples and pears, respectively; tip burn in lettuce and other leafy vegetables, black heart in celery, increased firmness in all crops and overall "finish".

Mg is a mobile element and is essential for chlorophyll synthesis and nitrogen metabolism, Mg also contributes to earlier growth, uniformity, sugar formation, seed development, winter hardiness and disease resistance. Mg also tends to decrease leaf and fruit drop and assist the maturing process.

Timing: Season-Long

Critical Elements

Phosphorus (P)

Key Physiological Roles/Comments

Adequate phosphorus levels must be monitored during the entire growing season. Phosphorus is the premier maturation element, is fundamental to energy transfer in plant cells, and basic to the formation of nucleic acids (RNA and DNA). Phosphorus promotes root growth, flower and seed development. Work in Idaho has shown potatoes will require 0.3 lbs/ac. P to bulk an additional 700 lbs potatoes per day during the last 30 days of the growing season.