ULTRA GRO
Ag is Life

Fertilization and Nutrients for Strawberry Plants

Getting Off to a Great Start

California is the top strawberry producing state within the U.S….here are a few fun facts:

- We produce over 91 percent of the entire US strawberry crop.
- That's 186,400,740 flats YTD, with a value in excess of $2.36B.
- Strawberries use less than 1% of California's farmland, yet produce the fourth most valuable crop in California and are exported to over 30 Countries!
- California strawberry growers are pioneers in organic strawberry production with more organic acreage in California than anywhere else in the world.

Nutrition and fertilization are important factors in maintaining healthy and productive strawberry plants. It is difficult to provide precise recommendations for a particular farm because many factors influence nutrient uptake and availability including pH, moisture, organic matter content, clay content, mineral composition, tillage, herbicide use, fertilization history and weather. Using a combination of soil testing, tissue analysis, scheduled fertilizer applications and experienced observation of crop response, we have found consistent results with our growers in both the Oxnard/Santa Maria and Salinas/Watsonville markets.

It bears repeating, the key to optimizing strawberry fertility is effective and timely use of two essential agronomic tools: soil testing and plant tissue analysis. For example, re-planting fertilizer applications should be based on soil test recommendations rather than a fixed rate. We begin taking plant tissue analysis when spring growth begins and should be done every two weeks throughout blooming and fruiting stages. Fertility rec's will then be modified as per the lab results. Whereas the soil test measures the amount of nutrients present in the soil, plant tissue testing determines the level of nutrients that the strawberry plants are taking up. The laboratory measures concentrations of essential nutrients within the strawberry leaves and compares them to established target concentrations at each growth stage. Nutrient deficiencies can be detected and corrected before visual symptoms manifest and crop yields, quality, or both are impacted. Additionally, strawberry tissue analysis measures the petiole nitrate-nitrogen concentrations, which provide the basis for a precise nitrogen rate recommendation during bloom and fruit development.

Bottom-line: Strawberries require the right nutrients, at the right rate, at the right time, and in the right place to achieve the best results possible. It is very important to stay on top of these measurements and activities, please know we are happy to help and provide these services.

Soil preparation starts weeks before planting. Land preparation, including discing, fumigation and weed control sets us up for success. Optimal strawberry production requires a favorable root environment and the availability of essential nutrients. Soil pH is a key factor in maintaining a favorable root environment. Strawberries can grow over a wide range of soil pH but do best between pH 6.5–7.0. It not only affects root growth but influences availability of many nutrients. Pre-plant fertilizer, a soil analysis before planting can be used to determine the nutrient state of

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the soil and to develop a fertilizer program. Apply base fertilizer before the final cultivation and thoroughly incorporate into the soil before laying down plastic mulch. Know your products, direct contact between newly planted transplants and soil fertilizers can damage roots and reduce essential growth.

Soilborne diseases, plant-parasitic nematodes, and weeds can be devastating to a strawberry planting, and preplant soil fumigation is relied upon to mitigate the risk of crop loss. Fumigants are used to reduce disease and nematode pressure. But they also have a negative effect on the total soil microbial community (soil biome). Soil microorganisms have a variety of beneficial and deleterious effects on plants, impacting such processes as plant growth, soil nutrient cycling, crop yield, disease resistance and tolerance to an array of biotic and abiotic stressors.

The disruption of soil microbial community structures, particularly when beneficial soil biota are altered, has been shown to reduce crop yield and leave plants susceptible to disease following fumigation. Soil inoculation is the introduction of certain desirable bacteria into the soil. Soil inoculation is a convenient method to deliver bioformulation in field. Research shows that soil inoculation increases plant growth potential, disease resistance, and resistance to environmental stresses.

A correct balance between macronutrients and micronutrients is essential to achieve the best possible yield and quality from strawberries. A deficiency of any single nutrient is enough to limit crop yield or quality and the availability of each nutrient needs to be related to the crop requirements.

It is also important to adjust nutrient needs according to production system and yield expectation as there are some major differences between cultivars – some varieties can require twice as much nitrogen (N), phosphorus (P) and potassium (K) as others.

Micronutrients: While much lower levels of micronutrients are needed, all play a role, particularly in supporting plant growth, yield, and fruit quality. The most important micronutrients taken up are iron (Fe), manganese (Mn), boron (B), zinc (Zn), and copper (Cu).

Trans-planting to Establishment:

Nitrogen (N) - to build reserves in the crown for recycling and subsequent growth of new leaves in the spring. *Phosphorus* (P), *calcium* (Ca), *boron* (B) and *zinc* (Zn) - to maximize strong root development and support new growth. *Potassium* (K) - for good plant development.

Vegetative growth:

Nitrogen (N) - main doses are required at this stage for leaf and plant expansion. *Phosphorus* (P) - to meet uptake needs through flowering. *Potassium* - to promote strong lead growth and build a strong plant development. *Calcium* (Ca) - to build levels in the plant and maintain a steady supply to

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Getting Off to a Great Start

developing tissues. *Sulfur* (S) and *magnesium* (Mg) - maintain vigorous, healthy leaf growth and to improve plant supplies. *Micronutrients* - ensure photosynthetic growth is not limiting.

Flowering to fruit set:

Potassium (K)- peak demand for berry development and to build fruit quality. *Nitrogen* (N) - in reduced amounts so as not compromise fruit stability. *Phosphorus* (P) - for strong flower bud formation. *Calcium* (Ca) *and magnesium* (Mg) - to support new tissue development and boost fruit integrity, reduce disease and maximize shelf life. *Boron* (B) - for good pollen production, seed formation and fruit set. Other *micronutrients* - as needed to maintain growth.

Fruiting to maturity:

Potassium (K) - to maximize fruit quality, particularly TSS, acidity and taste. *Phosphorus* (P) - to top up levels being redistributed to the fruit. *Nitrogen* (N) - in limited quantities to balance other nutrients (excessive N at this stage can spoil fruit, but too little N reduces fruit size). *Boron* (B) and *calcium* (Ca) - for fruit strength.

Plant Nutrient Functions

Nutrient	**Main functions**
Nitrogen (N)	Building block of proteins (growth and yield).
Phosphorus (P)	Cellular division and formation of energetic structures.
Potassium (K)	Transport of sugars, stomata control, cofactor of many enzymes, reduces susceptibility to plant diseases.
Calcium (Ca)	A major building blocks in cell wall and reduces susceptibility to diseases.
Sulfur (S)	Synthesis of essential amino acids cysteine and methionine.
Magnesium (Mg)	Central part of chlorophyll molecule.
Iron (Fe)	Chlorophyll synthesis.
Manganese (Mn)	Necessary in the photosynthesis process.
Boron (B)	Formation of cell wall. Germination and elongation of pollen tube. Participates in the metabolism and transport of sugars.
Zinc (Zn)	Auxins synthesis; enzymes activation.
Copper (Cu)	Influences in the metabolism of nitrogen and carbohydrates.
Molybdenum (Mo)	Component of nitrate-reductase and nitrogenase enzymes.

Key points

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- ✔ Nutrient management depends on the production system, soil type, crop history, nutrient sources, and nutrient delivery systems.
- ✔ All strawberry plants need nitrogen (N), phosphorus (P), potassium (K), and other nutrients for vigorous vegetative growth and fruit production.
- ✔ Strawberry plants are extremely sensitive to salinity, high salinity will limit the uptake of potassium (K).
- ✔ Potassium may compete with magnesium for uptake by the roots. A ratio (4:1, K:Mg) in the soil solution is recommended to prevent one of these nutrients competing the other, thereby creating a deficiency.
- ✔ Potassium is required by strawberry plants to help them acquire water through the roots and control water loss by transpiration.
- ✔ Nutrient management tools include soil-applied fertilizer, fertigation, foliar feeding, and maintaining organic matter.
- ✔ In general, growers should apply P, K, and part of the N before planting. Time subsequent applications depending on the production system and leaf tissue analysis.
- ✔ Use soil testing, foliar testing, and plant vigor to fine-tune your nutrient management — do not rely only on general recommendations.
- ✔ Take care not to over-fertilize with N.

Ultra Gro's Role

We have a great reputation for highly effective products that show a difference in the plants and fruit within a matter of days, not weeks. But, for many of our growers, our most important contribution to their success is our team of advisors. We take great pride in "doing the work" and "doing what's right for the grower". Please give us a call:

In Santa Maria/Oxnard: Terry Schultz (805) 868-0175 or Miguel Gutierrez (805) 210-0157
In Watsonville/Salinas: Jesse Sanchez (559) 706-6705