

Fertilization

Most agricultural soils in California contain sufficient potassium and micronutrients to produce a tomato crop. Moderate applications of nitrogen and phosphorus are all that are required to promote seedling growth and produce maximum yields in most fields. A few may have toxic levels of certain salts.

Preplant soil testing is the primary tool for assessing nutritional needs. Depending on need, fertilizer may be applied preplant, or any time up to first red fruit. Plant tissue testing is a useful technique to confirm the adequacy of fertilization.

Higher than required rates of nitrogen and phosphorus can be both detrimental to the crop and the environment through surface runoff into waterways and leaching into groundwater. To avoid runoff of fertilizer, take [measures to reduce adverse water quality problems from runoff\(/agriculture/tomato/Irrigation-of-Processing-Tomatoes/#WATER\)](#).

Preplant fertilization should be based on soil test nutrient levels. For the most accurate estimation of soil nutrient availability, collect and analyze soil from the main, active rooting zone, which for tomatoes is the top foot of soil. Sample a minimum of 12 soil cores from each field; if zones of different soil texture exist within the same field, take separate samples to represent each major soil type. The following table suggests appropriate soil analysis procedures, and interpretation of laboratory results. Acceptable soil pH range for tomatoes is 5.8 to 6.8, with an idea range of 6.0 to 6.8. They do well up to pH 7.6 if there is no deficiency of essential nutrients. Vegetables in the very tolerant group grow satisfactorily at a soil pH as low as 5.0. For the most part, even the most tolerant crops grow better at pH 6.0–6.8 than in more acidic soils. Calcium, phosphorus, magnesium, and molybdenum are the nutrients most likely to be deficient in acidic soils.

Commonly used laboratory procedures for soil analysis and interpretation of results

	Element and soil test procedure				
Soil test interpretation	Phosphorus ¹ (Olsen, bicarbonate extraction)	Potassium (ammonium acetate extraction)	Zinc (DPTA extraction)	Soluble salts; EC (saturated paste)	Boron (saturated paste)
Low	< 15 ppm	< 130 ppm	< 0.5 ppm	< 2 dS/m	< 1 ppm
Medium	15-25 ppm	130-250 ppm	0.5-1.0 ppm	2-4 dS/m	1-5 ppm
High	> 25 ppm	> 250 ppm	> 1.0 ppm	> 4 dS/m	> 5 ppm

Key: < = less than; > = greater than; dS/m = mmho/cm; ppm = parts per million; EC = electrical conductivity	
¹	Method estimates the relative bioavailability of inorganic orthophosphate (PO ₄ -P) in soils with neutral to alkaline pH. Not appropriate for soils with pH < 6.5.

Phosphorus, Potassium, and Zinc

For phosphorus, potassium, and zinc a low soil test value suggests the need to fertilize; with medium soil levels, yield response to fertilizer application is possible, but not necessarily likely. At high soil test levels, yield response is unlikely. For phosphorus and zinc, fertilization is best done preplant, or as a starter solution at seeding or transplanting; potassium can be applied preplant, at sidedressing, or fertigated (injected into drip irrigation water) during the growing season. Application rates up to 150 lb P₂O₅ and 200 lb K₂O are appropriate for soils testing low in these nutrients; in fields with medium test levels, 100 lb P₂ O₅ and 150 lb K₂O is justified.

Soluble Salts and Boron

For soluble salts (salinity) and boron, soils in the low range are desirable. As soil levels increase, the likelihood of crop damage increases; when high levels of either soluble salts or boron are present, remedial actions are justified. Actions include leaching the soil profile, sprinkling during crop establishment to create a zone of lower concentration around the seedlings or transplants, and switching to a higher quality irrigation source to prevent further buildup (high soil salinity and boron is often the result of using marginal quality irrigation water).

Available Nitrogen

Preplant soil testing for available nitrogen (N) is not recommended. Samples taken in the fall are undependable because winter rain or preirrigation can leach nitrate from the root zone. Soil nitrate sampling after crop establishment is useful to guide in-season nitrogen management. However, regardless of soil $\text{NO}_3\text{-N}$ levels, heavy preplant nitrogen fertilization is not recommended. Early season crop nitrogen requirements are modest, and the amount of nitrogen typically contained in common phosphorus fertilizers is sufficient to maintain the crop until sidedressing or fertigation (applying fertilizers through drip irrigation) can be done.

Planting to Red Fruit Stage Activities

Fertilizer Application at Transplanting

It is common practice to apply standard phosphorous fertilizers (such as 10-34-0) in transplant drenches. To minimize the potential toxicity of these fertilizers, which are high in salts, limit the application rate to no more than 2 gallons of the concentrated fertilizer per 100 gal of transplant solution.

Fertilizer Application in Furrow-Irrigated Fields

The majority of seasonal nitrogen fertilization is typically applied in a single sidedressing. A seasonal nitrogen application of about 150 lb per acre is nearly always adequate for maximum fruit yield and quality with furrow irrigation. Factoring in nitrogen applied with phosphorous fertilizer, a single sidedress application of 100 to 120 lb nitrogen per acre is normally sufficient to finish the crop. Fields with significant residual soil $\text{NO}_3\text{-N}$ require less sidedress nitrogen; fields with soil $\text{NO}_3\text{-N}$ greater than 15 ppm in the top foot of soil before sidedressing generally require no more than 50 lb nitrogen per acre at sidedressing.

Use of higher seasonal nitrogen rates can be both detrimental to the environment (nitrogen-rich tailwater or drain tile effluent can stimulate algae growth in the receiving water body), and to the crop. Lush vine growth stimulated by excessive nitrogen application can require additional equipment passes to trim vines and may increase fruit rot and mold problems.

A sidedress potassium (K) application can be an effective practice in fields with limited potassium supply. Because many California soils tend to fix applied potassium over time (making it less available to the crop), a banded sidedress potassium application at 100 to 200 lb K_2O may be more effective than a preplant application.

Fertilizer Application in Drip-Irrigated Fields (Fertigation)

Multiple applications of nitrogen and potassium, where necessary, are injected with irrigation beginning as early as prebloom. Concentrate fertigation during the rapid growth phase of the crop, which extends from early bloom until first red fruit. Due to the higher yield potential when using drip irrigation, seasonal nitrogen rates as high as 250 lb per acre are justified. Fields with high residual $\text{NO}_3\text{-N}$ will require less nitrogen. Nitrogen application in excess of crop demand can result in excessive vine growth, which can increase fruit mold problems. Although fertilizer can be injected with each irrigation, fertigation more often than once per week is generally unnecessary.

For more information, see [Drip Irrigation and Fertigation Management of Processing Tomato](https://vrhc.ucdavis.edu/pdf/TOMATO/tomato_drip%20irrigation%20and%20fertigation%20mgmt%20of%20processing%20tomato%202009_05.pdf)(https://vrhc.ucdavis.edu/pdf/TOMATO/tomato_drip%20irrigation%20and%20fertigation%20mgmt%20of%20processing%20tomato%202009_05.pdf).

Nutrient Monitoring

Plant tissue testing can be done to help identify any growth-limiting nutrient deficiency. Whole leaf total N/P/K analysis, the best overall measure of crop nutrient status, is most useful from early flowering through full bloom. After full bloom tissue nutrient

concentration is heavily influenced by nutrient export to fruit; low tissue values may not reflect nutrient deficiency.

The table below lists nutrient sufficiency guidelines. If leaf tissue analysis suggests that the crop is nutrient deficient, supplemental fertilization should be considered. Foliar fertilization can be effective for micronutrients, but the amount of NPK fertilizer that can be safely applied is severely limited by potential crop phytotoxicity.

Whole leaf nutrient sufficiency guidelines

Nutrient	Sufficiency range by growth stage	
	First flower	Full bloom
% N	4.6–5.2	3.5–4.5
% P	0.32–0.49	0.25–0.41
% K	2.2–3.5	1.6–3.1

() N = nitrogen, P = phosphorus, K = potassium



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