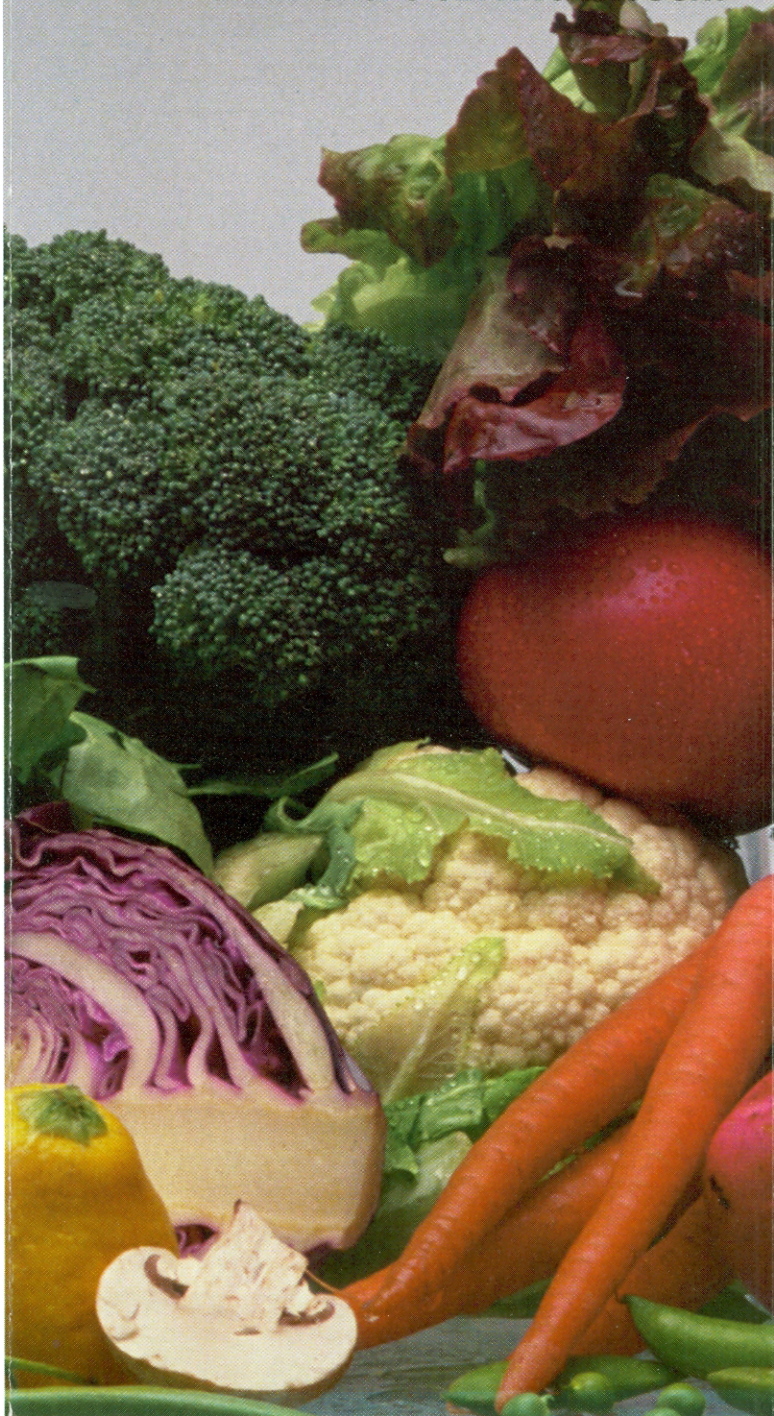


SULPHUR

ARE CALIFORNIA CROPS GETTING ENOUGH?



SULPHUR: AN ESSENTIAL NUTRIENT

Sulphur deficiency isn't a new problem for California farmers. In the 1950s, university researchers identified sulphur deficiency in 56 of the state's 58 counties. The deficiency occurred in a variety of soil types, but primarily in coarse-textured or sandy soils, which tend to be low in organic matter.

Fortunately, many of the N-P-K sources used at the time—ammonium sulphate (21-0-0-24S), single superphosphate (0-20-0-12S), potassium sulphate (0-0-53-18S) and others—contained significant levels of sulphur. Without realizing it, farmers were providing crops with ample amounts of this important nutrient.

But that's no longer the case. In many fields, sulphur is being removed from soils at a faster rate than it's being replenished, for the following reasons:

- **Lack of sulphur in high-analysis N-P-K fertilizers.** Urea, urea-ammonium nitrate solutions, ammonium polyphosphate, diammonium phosphate, triple superphosphate and potassium chloride have become primary sources of N, P and K. These are excellent sources of plant food, but they lack the sulphur found in many mixed fertilizers.
- **More intensive land use.** High yields and double cropping naturally tax soil nutrient reserves. This is a major reason for sulphur deficiency in California, where new plant varieties and other high-yield cropping practices can accelerate nutrient depletion.
- **Nutrient mobility.** Sulphur is a highly mobile nutrient. Heavy rains or irrigation can move sulphur beyond the reach of shallow-rooted crops. While the reduced availability and higher cost of water throughout the state have forced farmers to become more efficient with irrigation, soil specialists note that irrigation is still required to remove sodium from root zones. When sodium is carried beneath the root zone, sulphur is leached as well.

For years, soil specialists have referred to sulphur as “the fourth major nutrient.” And it's easy to see why.

Sulphur is a building block for protein and one of the 17 essential elements needed to support plant life. In fact, plants frequently need as much sulphur as they do phosphorus or magnesium.

Without adequate sulphur, crops simply can't reach their full potential in terms of yield, protein content or quality. Sulphur deficiency also prevents crops from making efficient use of applied nitrogen and phosphorus.

TYPICAL SULPHUR REQUIREMENTS FOR HIGH-YIELD CROPS

Crop	Yield/ac	Sulphur removed (lbs/ac)
Alfalfa	10 tons	55
Cabbage	25 tons	50
Clovers	5 tons	30
Corn (grain)	250 bushels	50
Cotton	3.5 bales	30
Grasses	6 tons	30
Onions	25 tons	35
Rice (grain)	3.5 tons	18
Turnips	30 tons	50
Wheat (grain)	80 bushels	20

Source: *The Fourth Major Nutrient*, The Sulphur Institute

SULPHUR DEFICIENCIES—WHEN AND WHERE?

Sulphur deficiency can occur almost anywhere. However, it is most common in fields with coarse-textured soils that are low in organic matter.

In the coastal ranges, sulphur deficiencies have been found from Salinas south to San Luis Obispo, and from San Francisco north into Humboldt County. These soils vary from coarse soils to loams and silt loams found along the river flood plains.

In the Central Valley, sulphur deficiencies generally have been associated with coarse-textured or sandy soils along the east side of the San Joaquin Valley, and in the Sacramento Valley, particularly when soils remain saturated and cool in the spring.

Farmers should pay particular attention to sulphur needs in winter crops. When temperatures are cooler and the soil moisture content is high, bacterial conversion of natural sulphur to the sulphate form dwindles. If rainfall is heavy, sulphur may leach out, diminishing the sulphur available to plants.

HOW TO IDENTIFY SULPHUR DEFICIENCY

Crops deficient in sulphur turn yellowish in color and have stunted growth. Since these symptoms can easily be confused with nitrogen deficiency, agronomists suggest obtaining a plant tissue analysis early

in crop growth, when the signs of trouble first appear. As a general rule, plants should have more than 0.15% sulphur content. Anything less indicates a sulphur deficiency.

Applying sulphate—the form of sulphur most readily available to crops—can quickly correct a sulphur deficiency and prevent further reductions in yield and quality. Generally, sulphur supplied in the elemental form, unless of fine particle size, needs time to break down and is best suited for rebuilding sulphur levels over time.

WAYS TO PREVENT SULPHUR DEFICIENCY

Preventing a nutrient deficiency is always preferable to treating an existing deficiency. That's why many agronomists advise farmers to include sulphur routinely in the fertilization program for virtually all crops planted in sandy soils or medium- to coarse-textured soils. Even some heavier or clay soils may lack enough sulphur for optimal plant growth and should be tested.

Maintenance applications of 15–25 pounds of sulphur per crop per year are recommended on soils that are prone to sulphur deficiency. In double-cropping situations, a total of 20–30 pounds of sulphur per acre per year may be advised. For cole crops, as much as 50 pounds per acre per year may be required. The higher added amounts of sulphur required for double-cropping and specialty crops should be spread out among preplant, at-planting and post-emergence applications for maximum efficiency. Topdressing winter crops in the spring also may be necessary if temperatures have been especially cool and the weather wet. Again, plant-tissue analysis can help farmers determine if their crops need more sulphur.

RETURN ON INVESTMENT

Sulphur is available in a variety of forms for inclusion in a wide range of cropping systems. However, the return for the money spent on sulphur fertilizer will vary depending on the responsiveness of the crop.

Experience has shown that, in responsive fields, adding sulphur can increase the yield of alfalfa hay by one ton or more per acre. In fields with sulphur deficiencies serious enough to compromise crop quality, yield can be doubled. Farmers can reap an estimated \$3–\$4 for every dollar spent on sulphur fertilizer.

Remember, specific sulphur fertilizer requirements vary among crops and soils, and also are affected by the season and the weather. For best results, talk to your fertilizer dealer, crop consultant, or extension farm advisor.

WHAT CALIFORNIA SOIL SPECIALISTS HAVE TO SAY—

"If sulphur is deficient, adding sulphur is going to make the difference between an economic yield and a crop that isn't profitable."

Robert C. Dixon
Consulting Agronomist
Stockton

"More farmers ought to be using sulphur in their fertilizer program. They shouldn't risk a sulphur deficiency. In my book, added sulphur is the best insurance you can have."

Carl Spiva
Consulting Agronomist
Modesto

"It's important to monitor a crop's sulphur needs with plant tissue analysis. There's no doubt that adding sulphur in responsive soils is well worth the money."

Dr. Roland D. Meyer
Extension Soils Specialist
University of California-Davis

"N-P-K [nitrogen, phosphorus, potassium] have been long considered the macronutrients, and sulphur has been classified as secondary. I think the macronutrients should be N-P-K-S."

Irv Phillips
Environmental Plant Nutritionist
Columbia

Additional information about sulphur in agriculture can be obtained by contacting:



The Sulphur Institute
1140 Connecticut Avenue, NW, Suite 612
Washington DC 20036, USA
Telephone: +1 (202) 331-9660
Facsimile : +1 (202) 293-2940
E-mail: sulphur@sulphurinstitute.org