SULPHUR IN CROP PRODUCTION

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Sulphur (S) is an essential plant nutrient required by all crops for optimum production. Plants take up and use S in the sulphate (SO_4 -S) form, which like nitrate (NO_3 -N), is very mobile in the soil and is prone to leaching in wet soil conditions, particularly in sandy soils.

Sulphur deficiencies are becoming increasingly common in Alberta. Deficiencies can be easily corrected with fertilizers containing sulphate (SO_4). Generally, S is the third most limiting soil nutrient in cereal, oilseed and forage crop production in Alberta. It is third only to nitrogen (N) and phosphorus (P) in fertilizer use in Alberta.

Oilseed crops, particularly canola, and forage crops, have a higher S requirement than cereal crops. Table 1 provides examples of nutrient uptake and removal by wheat, canola, pea and alfalfa. Sulphur is required in the development of fertile canola flowers and must be present for good nodule development on legume forages such as alfalfa and pulse crop roots such as pea and faba bean.

Soil organic matter is the primary source of plant-available SO_4 -S in surface soil. Soils that are sandy, low in organic matter and found in upper to mid-slope field positions are particularly prone to S deficiency since only a small amount of SO_4 -S is released from organic matter and is susceptible to leaching loss.

Table 1. Nutrient levels taken up and removed by average yields of canola, wheat and alfalfa in Alberta

Crop	Yield	Crop Part	Nitrogen N	Phosphate P_2O_5	Potassium K_2O	Sulphur S
			(lbs/acre)			
Canola	35 bu/ac	Seed	60-75	30 - 35	15 - 20	10 - 12
		Seed/straw	100 - 115	45 - 50	75 - 85	17 - 20
Wheat	50 bu/ac	Seed	60 - 75	24 - 28	70 - 85	10 - 12
		Seed/straw	85 - 110	32 - 36	15 - 22	5 - 6
Pea	50 bu/ac	Seed	100 - 120	30 - 35	30 - 35	6 - 7
		Seed/straw	130 - 150	35 - 45	120 - 140	10 - 14
Alfalfa	5 tons/ac	Total	260 - 320	60 - 75	270 - 330	27 - 33

Sulphur is essential in the structural and enzymatic components in plants. Sulphur is a key component of some essential amino acids and is needed for protein synthesis. Chlorophyll synthesis also requires S. Sulphur is not readily translocated within plants, so all plants need a continuous supply of sulphur from emergence to crop maturity. Therefore, in S-deficient plants, older leaves may appear more healthy, while newer leaves and tissue may have stunted growth and a lighter green or even yellow appearance. A sulphur deficiency at any growth stage can result in reduced crop growth and yield. Adequate S results in rapid crop growth and earlier maturity.

> All plants need a continuous supply of sulphur from emergence to crop maturity

Sulphur deficiency symptoms vary between crops. In canola, deficiency symptoms may begin as early as the one-leaf stage, with the newest leaves turning yellowish green with dark vein coloration. Leaves may take on a "cupped" appearance and later, a reddening from the leaf margins. Flowers are usually smaller and paler yellow, and they produce small, underdeveloped purplish-coloured pods. Under mild S deficiency, there may be good vegetative growth, but flowers and pods will be underdeveloped. For cereals and forage grasses, the yellowing of newly emerging leaves is a strong indicator of S deficiency. Depending on the degree of deficiency, the leaves may be a shade of light green to entirely yellow. Yellowing of the new growth occurs because S is immobile in the plant; therefore, newly emerging leaves cannot "scavenge" S from older leaves. This situation is in contrast to nitrogen deficiency symptoms in which the older leaves turn yellow first because nitrogen is translocated or "scavenged" from older leaves to support new growth.

Sulphur deficiency in alfalfa results in shorter plant stature with pale green to yellow leaves. The yellowing is often, but not always, localized to newly emerging leaves. Sulphur deficiency can result in nitrogen deficiency in alfalfa since S is required for health and function of nitrogen-fixing nodules. Sulphur deficiency in alfalfa occurs more commonly and is more severe in Gray Wooded soil.

https://www.canolawatch.org/2011/06/01/do-you-see-sulphur-deficiency-symptoms/
https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex3526/$file/542-10.pdf?OpenElement

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