Sulphur Management in Spring Canola

Final Report

Purpose:

This project evaluated the response of canola to applied fertilizer sulphur. Atmospheric sulphur dioxide deposition (acid rain) has steadily declined by over 50% during the past 20 years. Environment Canada estimates deposits have decreased from 25-30 kg/ha/yr. in 1990 to 9-11 kg/ha/yr. by 2010. Many farmers have increased their use of sulphur in response to more frequent reports of sulphur deficiency symptoms appearing in canola, winter wheat and alfalfa. This project evaluated the response to sulphur in canola

Canola requires more than 20 lbs. S/ac (23 lbs. S/tonne); alfalfa requires about 25 lbsS/ac (5 lbsS/ton). Sulphur is not mobile in plants so a continuous supply is required. Most of the sulphur in soil is associated with organic matter. Availability is highly variable from year to year and site to site and is subject to leaching as experienced with nitrogen. This project was built on previous best management practices trials to evaluate the yield and economic return to fertilizer sulphur applications.

Methods:

From 2010-2012 the project evaluated applying 20 lbsS/ac compared to an untreated check (no sulphur). This rate was selected based on published canola S plant removal rates and recommended application amounts required to correct a sulphur deficiency. In 2013-14 the treatments were expanded to include 10 & 40 lbsS/ac rate. The high rate was tested in response to a trial conducted at the Ont. Canola Growers crop production center in 2012 that showed a positive yield response to the higher rate. Sulphur was top-dressed just after planting as either ammonium or calcium sulphate. Ammonium nitrate was top-dressed to trials where ammonium sulphate was the sulphur source to equalize the nitrogen rate across treatments. Two to three replications were included at each site. A 30cm soil sample prior to planting was collected to measure soil sulphur. In 2013-14, whole plant tissue samples at the 4-6 leaf stage were collected to evaluate if tissue S concentration could be correlated to critical values.

Results:

Sulphur response varied significantly between years and sites. Sulphur response was the highest in 2012 and 2010.The average yield response over 30 locations and 5 years was 178 lbs/ac, a 9.4% increase (Figure 1). There was a positive yield response in over 70% of the trials, and positive return to sulphur (20 lbsS/ac) at 70% of sites. The average increase in return across all sites from applying 20 lbsS/ac was $25.00/acre ($450/t canola price, $0.57/lbS). There was not an economic benefit to applying more than 20 lbsS/ac. There was insufficient data to determine whether 10 or 20 lbsS/ac rate is adequate to meet crop needs. Tissue samples in 2013 indicated a relationship to sulphur rate, but this was not evident in 2014. Individual trial yield responses from 2010-2014 varied between 0 and +40%. At several sites where there was a large response to sulphur, sulphur deficiency symptoms were evident in the check (0 rate) treatments. We also conducted nitrogen rate trials in conjunction with the sulphur trials from 2010-2012. In these trials, there was a strong interaction between sulphur and nitrogen at sites where sulphur deficiency was evident (Figure 2). Higher nitrogen rates accentuated the sulphur deficiency symptoms and reduced yield. At these sites, the higher nitrogen rate accentuated the sulphur deficiency symptoms. A correct N: S balance is needed for

canola because where a deficiency occurs; there is insufficient S to combine with nitrogen to make protein. This is not to imply that N and S need to be balanced in fertilizer applications. Optimum yields of canola are achieved as long as individual amounts of N, P, K and S are supplied.

Figure 1: 2010-2014 Response of Canola to 20 lb. S/ac

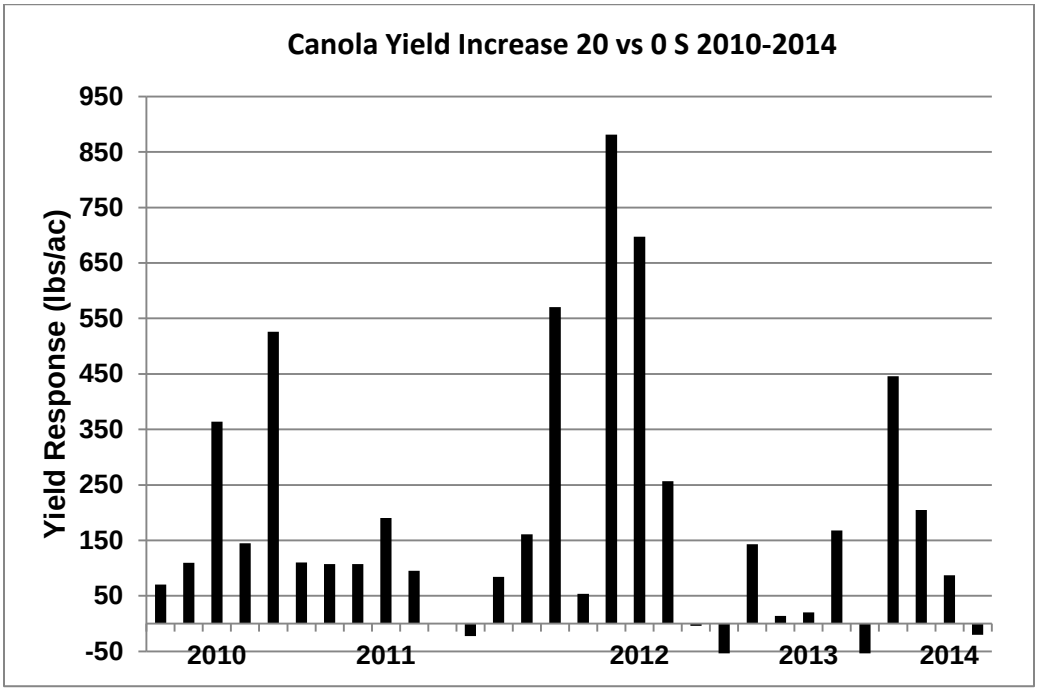
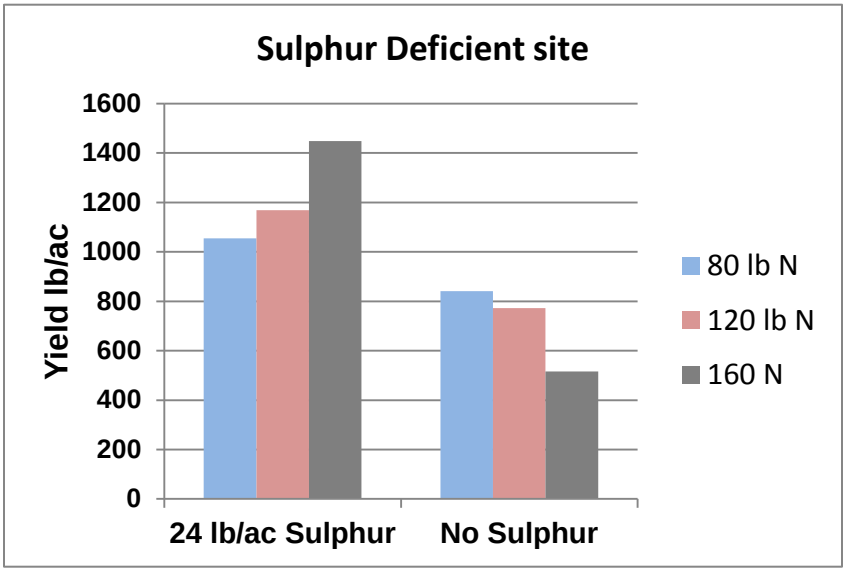


Figure 2: Nitrogen X Sulphur Interaction at Sulphur Deficient Site



Summary:

Results from this study provide strong support for application of sulphur to canola. The availability of sulphur is highly variable from field to field and with weather, many growers will opt to apply sulphur as 'insurance' against deficiency. The suggested rate of application as insurance is 15-25 lbsS/ac. There is no need to balance the N: S ratio in fertilizer applications. Our trials support other research that indicates that the sulphur soil test is not reliable predictor of the need for sulphur

Next Steps:

Further trials are needed to validate the whole plant tissue test at 4-6 leaf stage as S diagnostic tool. Sulphur rate trials at sulphur deficient sites are needed to validate the optimum sulphur rate.

Acknowledgements:

Special thanks to the Ontario Canola Growers Assoc., AAFC for funding and sponsoring the trials, individual co-operators for their enthusiasm, energy and time, and OMAFRA summer students

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