Alfalfa has the highest sulfur (S) requirements of any of the field crops, with a 5 ton/ac crop of alfalfa removing about 25 lb/ac of S. By comparison, a 45 bu/ac spring canola crop, which is also a high user of S, removes 15 lb/ac, and a 150 bu/ac corn crop removes 10 lb/ac S. Sulfur is immobile in the plant, so plants require a continuous supply. In Ontario, S deposition from acid rain has decreased steadily, and estimates are that the amount deposited has decreased by more than 50% since 1990. Instances of deficiency (Fig. 1) have been increasing because of reductions in the organic matter pool, higher crop yields, and higher protein yields. In the absence of a reliable S soil test, canola growers now routinely apply 15 to 25 lb/ac of sulfur as “insurance” because of an increase in cases of sulfur deficiency.

Ontario research on S rates, source, or timing have been limited. In a 2012 research study with alfalfa at a single low S-testing location, forage yield of an alfalfa–grass mix was improved by 1.55 ton/ac (from 2.2 to 3.1 ton/ac), protein content increased by 4%, and the percentage of alfalfa in the harvested forage was improved from 33 to 56%. A 2013 field survey of Ontario alfalfa stands indicated that 21% of fields had S tissue analysis below the 0.25% critical level for alfalfa. It is interesting to note also that 37% of fields tested below the 1.7% (Ontario) critical K value (Fig. 2).

To further investigate the need for S in alfalfa, a new field project was started in 2013 to look at the rates, timing, and form of S on alfalfa–grass yield and quality. Another goal was to refine tools for identifying S-responsive sites, using tissue and soil testing.

Methods

Three grower alfalfa–grass forage stands in western Ontario were selected in fall 2012 based on low S tissue analysis. The study was a randomized block design with three replications and a total of five treatments including a control. Two of the treatments included fall-applied elemental S at 50 or 100 lb/ac. Spring-applied treatments were either 50 lb S/ac as sulfate of potash or 142 lb K2O/ac as muriate of potash. The center 10 ft of each treatment was harvested using a forage plot harvester. Forage yield and quality were measured in each cut along with percent S content (top 6 inches of growth at bud). Soil S levels at 0 to 6 inches and 6 to 12 inches were collected before, during, and after growing season.

Results

Sulfur application improved forage yield on average by 620 lb/ac (8.7%) versus the control (KCl treatment) (Fig. 3). Of the three sites in southern Ontario, yield response to S was greater in second than first cut (third > first or second for the three-cut system). There were no significant differences between sulfur sources (i.e., elemental S vs. sulfate of potash). Sulfur applica-