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Sulfur Applications Boost Alfalfa Yields

In sites marginal or deficient in sulfur, tests indicate that consistent responses to sulfur fertilization can be achieved.

Summary. *Alfalfa consistently responded to sulfur (S) fertilization applications in both 2001 and 2002. It appears that on marginal sites (6 ppm SO_4-S), consistent responses up to 19 percent can be achieved with S fertilization. On highly deficient sites (<3 ppm SO_4-S), responses have been greater and have included increases in alfalfa forage quality as well as yield. All sources of S fertilizer appear to work equally well when applied in early spring to established stands of alfalfa.*

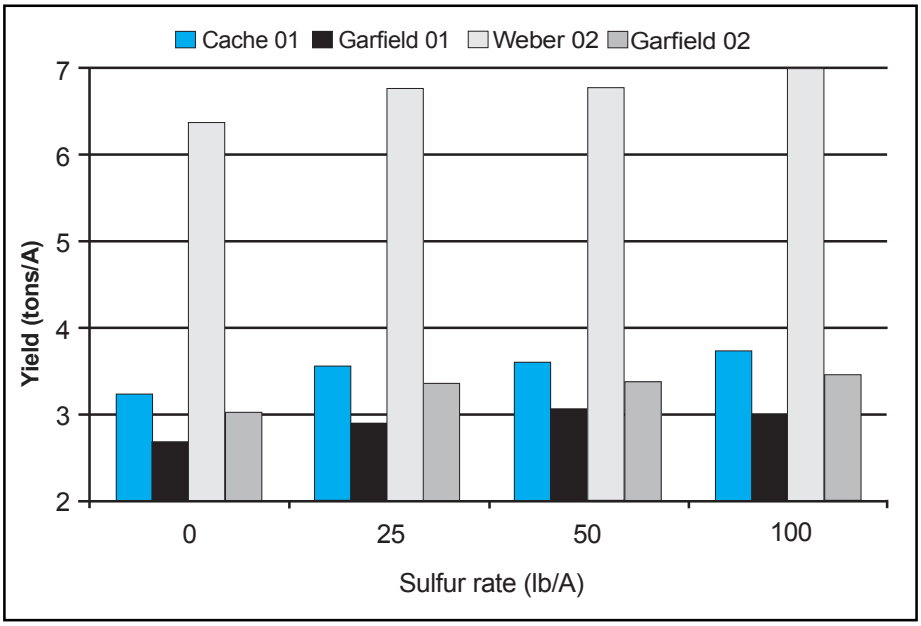

Figure 1. Effect of S rate on alfalfa hay yield at two locations in 2001 and 2002.

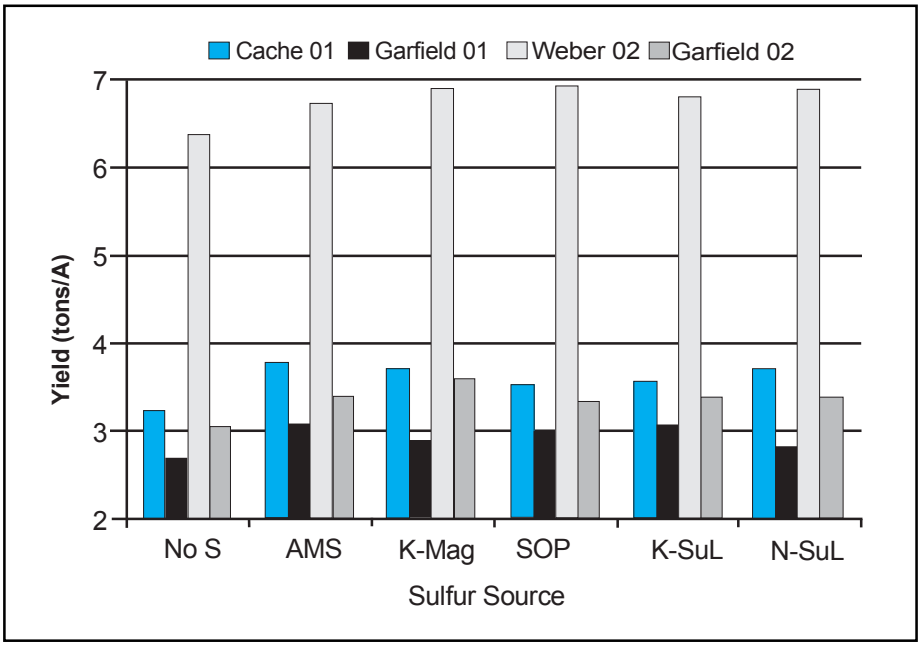

Figure 2. Effect of S source on alfalfa hay yield at two locations in 2001 and 2002.

Sulfur is an important component of several amino acids and has been shown to influence yield, protein content, and stand density of alfalfa. Yield responses of up to 300 percent have been reported under severe S deficiency conditions. However, more typical yield responses to S fertilization are in the range of 10 to 25 percent.

In the past, crop S requirements were met by depleting soil reserves, fortuitous contributions from other fertilizers, and atmospheric deposition. With high crop yields, the production of higher analysis fertilizers containing less S and reductions in atmospheric emissions, more S deficiencies in the soil are likely to occur. High-yielding alfalfa (>5 tons/A) will more likely result in soil S deficiencies as crop

Table 1. Selected soil properties from 0 to 12 inches depth at each site.

Year	Location	Texture	pH	SO_4-S (ppm)
2001	Cache	clay loam	7.7	3.5
2001	Garfield	sandy loam	7.8	3.0
2002	Weber	sandy loam	7.5	3.8
2002	Garfield	loam	7.0	6.3

demand exceeds soil supply capabilities.

In the Western U.S., alfalfa yields in excess of 8 tons/A can be achieved. These high yields, coupled with a long history of production and use of clean (low S) irrigation waters in alfalfa production areas, are resulting in more incidences of S deficiency and need for S fertilizer.

Effect of S on alfalfa has not been evaluated in Utah. Alfalfa yield varies throughout Utah, based on location, elevation, climate, and management system. Three to five cutting hay systems are common, depending on location in the State. In 1997-1998, symptoms of severe S deficiency were observed in irrigated alfalfa. A follow-up survey of soil samples submitted in 1998-1999 found more than 60 percent testing low in sulfate-S (SO_4-S below 8 ppm). Several new S fertilizer sources are now available, including fluid potassium polysulfide and ammonium polysulfide.

Our objective for this study was to compare the effects of different S sources and rates on irrigated alfalfa yield, as well as on plant tissue and soil test S concentrations.

Responses

S rate. Averaged over sources, sulfur increased yield by 0.34 to 0.61 ton/A (9 to 16 percent) above no S control (Figure 1). Generally, yield was maximized at the higher S rate of 100 lbs/A.

S source. Yield responses were similar with all S fertilizer sources (Figure 2). Averaged over rates, yield with these S sources was 0.45 to 0.56 ton/A (8 to 19 percent) higher than the no S control. In one site-year (Garfield, 2001) yield was decreased when higher rates of S were supplied by potassium-magnesium sulfate or ammonium polysulfide, due apparently to salt damage and direct tissue burn. The effects were not seen at the other sites or years.

Soil test sulfate-sulfur was increased by up to 8 to 15 ppm S (32 to 60 lbs/A of S) after fertilization in all site-years. Based on this soil sampling, it appears that S fertilization effects would persist for at least two years after applications occur. Additional analyses are ongoing to relate soil test SO_4-S to yield and tissue S concentrations.

Specifics

Soil properties. Sites were identified with relatively clean irrigation water sources and low residual soil test S levels (Table 1). Each site was in established alfalfa with stand ages ranging from 2 to 3 years old.

Fertilizers. Fluid potassium polysulfide (K-Sul, 23% S) and fluid ammonium polysulfide (N-Sul, 40% S) were applied at rates providing 25, 50, and 100 lbs/A of S. An untreated control was included. Potassium (KC1, 0-0-60) was applied to all treatments to balance K rates across the study at 300 lbs/A of K_20.

Application. Fluids were applied with an ATV-mounted sprayer with a 10-foot boom calibrated for each material. Both fluids were diluted 1:1 with water before applications.

Soil samples were collected from all plots after first harvest at 0 to 12 and 12 to 24-inch depths and analyzed for SO_4-S.

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