THE EFFECT OF VARIOUS SOIL AMENDMENTS ON THE YIELD OF BARLEY WHEN GROWN ON A SODIUM-AFFECTED SOIL

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Soil amendments have been used for many years to remove excess exchangeable sodium (Na), to improve soil physical and chemical properties, to improve water penetration, and ultimately to increase crop yield. Neutral salt amendments such as gypsum and acid-forming materials such as sulfuric acid and elemental sulfur have all been used successfully in Arizona when applied appropriately. A more precise ability to predict the amendment requirement of soils used for a specific crop and the evaluation of potentially new materials are ongoing needs in Arizona.

An experiment was conducted at the Safford Agricultural Center to evaluate the effect of various rates of four different amendments on the yield of barley when grown on a sodium-affected soil. The soil used was a Pima clay loam variant with the following chemical properties in the surface 15 cm: pH 7.8, ECe 2.5 mmhos/cm, nitrate-nitrogen 16.2 ppm, CO_2 extractable phosphorus 2.4 ppm P, and estimated exchangeable sodium percentage (ESP) 12.9.

The amendments used were agricultural gypsum, sulfuric acid, an aluminum sulfate based by-product material (Boligrow granules, Boliden Company, Boliden, Sweden), and a biological product (Huma-Blend, Bio Huma-netics Co.,Chandler,AZ). All treatments were replicated four times in a randomized block design. The amendments were broadcast applied preplant and worked into the surface 10-15 cm of soil just prior to pre-irrigation. All other cultural practices were performed uniformly over the entire plot area in accordance with practices recommended for optimum yields. 'Gus' barley was seeded on March 1, 1985. Plots were harvested on July 1, 1985. Average grain yield and bushel weights for selected treatments are listed in Table 1.

Yield differences among treatments were small, generally less than 12%. Only the high aluminum sulfate rate and the sulfuric acid treatment produced significantly higher yields than the check. Plots treated with the biological amendment produced the lowest yields of any of the non-check treatments. Both the aluminum sulfate material and gypsum were effective in increasing the bushel weight of barley.

Based on the results, it appears that the acid-forming amendments such as sulfuric acid and the aluminum sulfate material produced the largest yields. It also appears that at an ESP of about 13, there may not be a sufficient economic return to justify an amendment treatment for barley production.

The experiment will be continued during the remainder of 1985 with a sorghum crop and in 1986 with cotton. Detailed soil and plant analysis will be conducted to determine the effect of the amendments on the ESP's attained and the nutrient uptake by the indicator crops.

Table 1. Barley yield and bushel weight as affected by soil amendment treatment.

Treatment	Grain Yield lbs/acre	Bushel Weight lbs/bushel
544 lb/a aluminum sulfate	4330	46.8
943 lb/a aluminum sulfate	4560	48.1b
2105 lb/a aluminum sulfate	4640b	48.5b
809 lb/a gypsum	4395	46.9b
1615 lb/a gypsum	4305	47.4b
2423 lb/a gypsum	4500	49.0b
610 lb/a sulfuric acid	4710b	-
1+1 qt/a biological amend.	4220	-
2+2 qt/a biological amend.	4290	-
check	4205a	46.1a
LSD (.05)	425	0.72