COMPARISON OF CHLORIDE AND SULPHATE SALTS AS FERTILIZER SOURCES OF POTASSIUM FOR WALNUTS

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In 1987, we began a study comparing potassium chloride (KCl) and potassium sulphate (K_2SO_4) as fertilizer sources of potassium in a Stockton area walnut orchard. Trees in the orchard (Vina variety on Paradox hybrid rootstock) were planted at 55 trees/acre in 1979. Soil in the orchard is Stockton adobe clay. Until 1990 (when solid-set sprinklers were installed), the orchard was flood-irrigated using high quality water from a local irrigation district.

In October of 1987, we applied several rates of either KCl or K_2SO_4 to trees in 20-foot bands placed in 12-inch deep trenches dug six feet from both sides of trees. Potassium sulphate was applied at rates of 3500, 2333, or 1167 pounds per acre. Potassium chloride was applied at rates of 3000, 2000, or 1000 pounds per acre. These application rates were calculated to deliver comparable amounts of elemental K per acre, and are equivalent to 1890, 1260, and 630 pounds of K_2O per acre, respectively. After fertilizer placement, the trenches were refilled. Each treatment was replicated six times on individual trees located randomly in alternate rows in the orchard. Each side of trees in the intervening "guard" rows was treated with the same rate and material as trees in adjacent test rows. We evaluated the effects of these treatments by annual mid-summer leaf samples and by subjectively rating trees for visual symptoms of potassium deficiency. Visual evaluations were done during July and October the season after treatment, then once during the summers of 1990 and 1991.

Leaf potassium levels showed little change until the end of the first season after treatment (Table 1). By mid-summer of 1989, the second season after application, leaf K levels in all treatments were well above those of untreated trees, but still well below the 1% level considered sufficient for walnuts. During the third, and to a lesser extent the fourth, season after treatment, K levels remained high in trees treated with higher rates of either material, while trees treated at lower rates began to decline. In general, the two potassium sources, when compared at the same K levels, performed equally well in increasing and sustaining leaf K concentrations.

Trees treated with potassium chloride had elevated leaf chloride levels the season after application. At no time during that year, however, did trees show any sign of the marginal leaf scorching that is typical of chloride toxicity.

Changes in visual symptoms of K deficiency generally paralleled changes in leaf K levels (Table 2). Four years after treatment, trees treated at high rates of either fertilizer material showed significant reduction in K deficiency symptoms.

We interpret these findings to indicate that potassium chloride should be considered a safe and acceptable source of K for walnuts. One-time applications of KCl at high rates can spike leaf chloride concentrations to potentially hazardous levels. Adequate provision must be made for leaching chloride out of the root zone. Applications should be made during the fall, for example, so that moisture from winter rains can leach chloride ions out of the root zone before root activity begins in late winter.

We gratefully acknowledge the gracious cooperation of Origone Ranch, Stockton, in conducting this trial.

Table 1. Leaf K and Cl levels at various times after treatment

% Leaf K					
	DATE (MAT[1])				
Treatment	7/20/88 (9)	10/1/88 (12)	8/4/89 (21)	7/11/90 (33)	7/10/91 (45)
1	0.66ab[2]	0.91a	0.79a	1.12a	0.73a
2	0.74a	0.86ab	0.81a	0.93bc	0.67ab
3	0.62bc	0.71bc	0.71ab	0.79c	0.54bc
4	0.54c	0.76abc	0.70ab	1.04ab	0.82a
5	0.65b	0.82abc	0.70ab	0.95abc	0.67ab
6	0.64b	0.77abc	0.62b	0.89bc	0.69ab
7	0.64b	0.66c	0.45c	0.59d	0.41c
% Leaf Cl					
1	.37ab	.38c	.20b	.29a	.35a
2	.31bc	.37c	.19b	.24a	.30a
3	.30c	.32c	.19b	.29a	.30a
4	.33abc	.53a	.27a	.30a	.31a
5	.35abc	.52a	.27a	.32a	.34a
6	.37ab	.41bc	.22b	.27a	.30a
7	.38abc	.36c	.20b	.32a	.33a

[1] Months after treatment

[2] Means within columns followed by the same letter are not significantly different (LSD $p \leq .05$).

Table 2. Visual Rating[1] of Deficiency Symptoms

Treatment	9/22/87[2]	7/15/88	9/21/88	7/11/90	7/24/91
1	3.1a[3]	2.1a	2.0a	1.8abc	1.8bc
2	3.2a	2.4a	2.0a	1.4c	1.8bc
3	3.1a	2.8a	2.4a	1.8abc	2.4abc
4	3.0a	2.9a	2.5a	1.3c	1.4c
5	2.6a	2.0a	2.3a	1.5c	1.7bc
6	2.9a	2.4a	2.3a	1.6bc	2.5ab
7	3.2a	2.6a	2.5a	2.3a	3.4a

[1] 1 = No deficiency symptoms, to 5 = Severely deficient
[2] Pretreatment rating
[3] Means within columns followed by the same letter are not significantly different (LSD $p \leq .05$).