SOIL MANAGEMENT PRACTICES AS THEY RELATE TO SOIL TYPES AND ALFALFA GROWTH

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The eastern slopes of the San Joaquin Valley generally contain granitic, coarse loamy soils. In the past 60 to 70 years that irrigation has been practiced, alfalfa has been grown here with good yields.

In recent years, more problems have been encountered by growers in stand establishment, stand longevity, and yields. Often the problems are found after several generations of alfalfa and after tree crops, vine crops, and heavily cultivated vegetables. Most often, alfalfa grows in old tree sites or down grape rows.

Many of these sandy soils appear to be single grained in structure, fairly low in clay (5 to 15 percent), and vary greatly in silt content (from 5 to 20 percent). Fertility studies often reveal marginal phosphorus, sulfur, potassium and occasionally zinc and boron deficiencies.

Many fertilizer plots have been tried on these soils in the past. In 1970, near Turlock, California, a grower who had recently encountered poor alfalfa yields requested a plot. Soil samples revealed low phosphorus levels, 3 to 5 p.p.m. by the bicarbonate test, and just marginal potassium levels. The plot was designed with a commercial source of P and K, animal manure, and a combination of both. Suspecting soil physical problems, deep disc plowing across all plots was incorporated into the test.

Table 1 gives the results of the four cuttings from June 15-September 15. Fertilizers helped but deep tillage, with the organic material turned on edge, proved the significant factor. The first weed cutting was discarded, and the final cutting data are not yet available, but the last cutting in the field visually favors the deep tillage plots.

Too often fertilizer plots are disappointing to the grower. Combinations of animal manures and commercial fertilizers have been somewhat more successful.

Subsoiling has usually caused increased growth in the marks left by the loosening action of the deep shanks. A closer look at the density of the soil in the successful disc-plowed plot reveals real differences in soil harshness.

Table 2 is the average of six soil samples, and the differences at 0 to 2 inches and 2 to 4 inches are significant at the one percent level. Many researchers believe a bulk density of 1.55 to 1.6 in coarse soils are threshold values for impeding of roots.

Another plot established in 1970 with both commercial fertilizers and manure was a complete failure except down the subsoiler tracks. Table 3 shows the bulk density samples taken in the subsoiler marks and just several feet away where the soil was disced for planting. The difference in bulk density seemed to account for the row-type growth often typical of subsoiled fields.

The western slopes of the San Joaquin Valley generally contain high calcium status soils of the fine loamy type. Although yields are reportedly decreasing on some of these loamy and clay loam soils, fertilizer plots generally show responses indicated by soil or tissue tests.

Very recently a survey of peat Delta soils and fine Westside soils from Tracy to Los Banos indicates some minor compaction, bulk density changes. Areas of virgin non-farmed soils reveal even our fine textured soils are being compacted. The average density of clay loam soils in the 0- to 6-inch depth was 1.45. The average of fence row, virgin soils was 1.38.

Summary

Fertilizers, in combination with deep tillage, may aid materially the soil structure problems of alfalfa growing on coarse sandy soils. Large quantities of organic matter

through animal manures or cover crops may be the only method to sustain soil aeration, water penetration, and good root development.

The fine textured soils believed to be less subject to man-made compaction should be carefully observed for the early signs of yield reduction.

TABLE 1

EFFECTS OF MANURE, FERTILIZER & SEEDBED PREPARATION UPON YIELD OF ALFALFA
Crowell, Stanislaus County (Olson, Meyer & Martin)

TREATMENTS				YIELDS OF HAY--LBS./A.				
DISKED 8"								
Fertilizer	N	P_2O_5	K_2O	June 15	July 16	August 13	Sept. 15	TOTAL
None	0	0	0	1000	1100	1066	1433	4599
1500 6-20-20	90	300	300	1300	1167	1233	1333	5033
14 tons Manure .7-.7-1.4	196	196	392	1867	1100	1400	1466	5833
Manure & 6-20-20	296	496	692	1900	1267	1600	1366	6133
PLOWED 26"								
None	0	0	0	800	1033	1300	1200	4333
1500 6-20-20	90	300	300	1133	1333	1433	1400	5299
14 tons Manure .7-.7-1.4	196	196	392	1667	1900	2000	1567	7134
Manure & 6-20-20	296	496	692	1833	1833	2000	1667	7333
L.S.D. (Least Significant Diff.)				627	747	300	ns	1411

TABLE 2

Crowell Plot
Sandy Loam Alfalfa Soil
Bulk Density and Total Porosity

Depth	Disc Plowed 26 Inches Bulk Density	% Porosity*	Disced Bulk Density	% Porosity*
0-2"	1.51	38.2	1.63	32.7
2-4"	1.57	34.0	1.66	32.1
16-18"	1.66	32.1	1.67	32.0

* Porosity calculated: $\frac{\text{Total vol. of voids (saturation)}}{\text{Total vol. of core}}$

TABLE 3

Baptista Plot
Sandy Loam Alfalfa Soil

	Sampled in Subsoiler Mark		Disc Area	
Depth	Bulk Density	% Porosity*	Bulk Density	% Porosity*
0-2"	1.51	38.2	1.58	33.8
2-4"	1.64	32.5	1.75	30.6
16-18"	1.67	32.0	1.68	31.8

* Porosity calculated: $\frac{\text{Total vol. of voids (saturation)}}{\text{Total vol. of core}}$