within the soil, because once a root arrived at the container wall, it grew along the wall and was flattened.

Growth effects

As the plants grew larger and used more water, the presence of the highly compacted layers became more detrimental. After each irrigation, a water table tended to form above the compacted layers and persisted for a short time, depending on the size of the irrigation, and the dryness of the compacted layer. Root tips submerged for long periods in this water table were observed to die back, and many branch roots would form from the sides of the original root after the water had moved into the compacted layer. Whenever some root tips did die, water consumption by the plant decreased and overall plant vigor appeared poor until the new branch roots developed.

Was the restricted root penetration due to mechanical impedance or low oxygen supply? The average O.D.R. values for the cylinders photographed are presented in the table along with the depths of root penetration at termination of the experiment. The O.D.R. values in the upper low-compaction part of the containers were about the same in each container. However, O.D.R. values in the compacted layers were generally lower as soil compaction increased. The O.D.R. values in the compacted layers were lower than those which would allow root growth in uncompacted soil. In general, there was fairly good agreement between depth of penetration and O.D.R. indicating that, in this experiment, low aeration was sufficient to restrict root growth in the compacted layers. Mechanical impedance may well have been an additional factor slowing root growth, but the low soil aeration would have been sufficient to restrict roots even if mechanical impedance had not been a factor.

Interaction

Since no high O.D.R. values were measured in areas where roots were not growing, the effect of mechanical impedance alone could not be detected. Other experiments where O.D.R. values were artificially increased in compacted layers have been conducted to get a clearer picture of the interaction of mechanical impedance and soil aeration on root growth.

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Sprays for Aphid Control Increase Sugar Beet Yields in Davis Tests

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For the third consecutive year, sprays for aphid control applied to sugar beets planted at Davis, decreased yellows virus infection and substantially increased root production. Three sprays applied to beets planted in March, April or May, 1964, resulted in yield increases of 6, 9 and 5 tons per acre respectively.

SUGAR BEETS were planted March 1, April 1 and May 1, 1964, for these studies. At each planting date, some beets were sprayed a limited number of times; some were sprayed more frequently to provide protection from the time of emergence until aphid flights had ceased, and others were left unsprayed.

The spray schedules were as follows:

Planting dates	Dates of spray application							
	April			May				
	3	17	24	1	8	15	22	29
3/1	x	x		x				
3/1	x	x	x	x	x	x	x	x
4/1		x		x		x		
4/1		x	x	x	x	x	x	x
5/1						x		
5/1						x	x	x

The spray material used was Metasystox-R (0, 0, dimethyl S-2-(ethylsulfinyl) ethyl phosphorothioate) at 12 ounces in 40 gallons of water per acre, applied with a back-sprayer. This material has federal approval for use on sugar beets in the nation, but the current registration allows for only two applications, each at ½ pound per acre. An application may not be made later than 30 days prior to harvest, and tops may not be fed to dairy or meat animals. The recommendation of Metasystox-R as an aphicide by the University is pending a review of residue and performance data.

The effectiveness of the spray treatments was evaluated by disease counts and by yield data. In contrast to results for 1963 (as reported in *California Agriculture*, May 1964), yield increases resulted from three spray applications applied to beets planted in March and April. These three spray applications increased root yields about as much as the more extensive spray schedules (table 1). In 1963, three sprays applied to March- and April-planted beets increased yields only slightly. The improvement in effectiveness of limited sprays in 1964 could have resulted from the fewer numbers of winged aphids and the sharp peak of their flights, as indicated in the graph.

Yellows infection

Yellows infection was high for nonsprayed beets planted March 1 and April 1, but root yields were appreciably higher —about 5 tons per acre more than for beets planted on comparable dates of the previous two years. Improved production from the early planted beets could have resulted in part from a lower incidence

Weekly catches of green peach aphids trapped during April and May at Davis using 8 yellow pan water traps (graph to right).

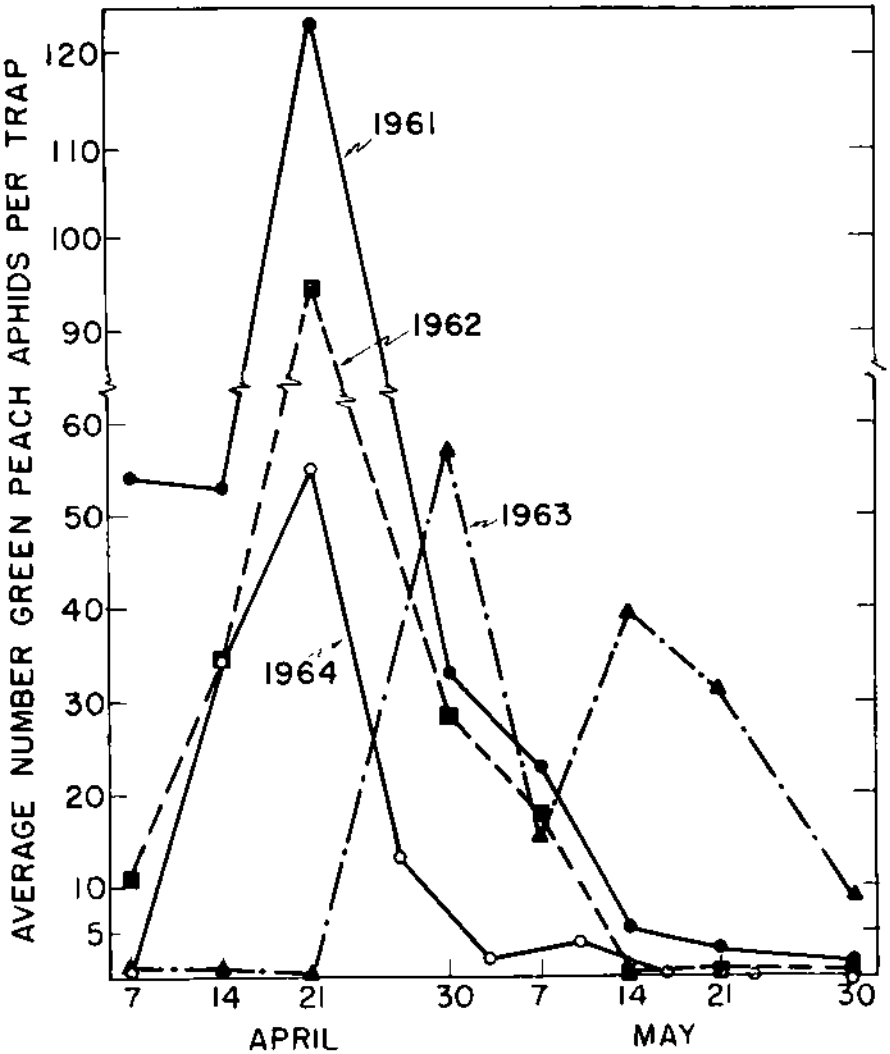

TABLE 1. EFFECT OF DATE OF PLANTING AND SPRAYS FOR APHID CONTROL ON NATURAL INFECTION BY YELLOWS VIRUSES AND SUGAR BEET PRODUCTION. EACH TREATMENT WAS REPLICATED FOUR TIMES. DAVIS, 1964

Date planted	Number of sprays*	Early yellows† infection, per cent	Harvest results‡ roots tons/acre	Harvest results‡ sucrose per cent
March 1	0	94	38.5	13.2
	3	73	44.9	11.7
	8	58	47.6	12.8
April 1	0	91	37.2	12.5
	3	46	46.6	13.2
	7	32	46.0	14.2
May 1	0	16	37.3	12.6
	1	21	37.9	13.3
	3	5	42.2	12.5
LSD, 5%			3.5	n.s.

* Metasystox-R, 12 oz/acre in 40 gals. water, applied by back-pack sprayer.

† Virus infection was evaluated eight weeks after the plants of each planting date were thinned.

‡ Average of harvests of October 26 and December. These harvests produced essentially the same root yields.

TABLE 2. EFFECT OF DATE OF PLANTING ON SUGAR BEET PRODUCTION. VALUES ARE MEANS OF FOUR REPLICATIONS.
PLEASANTON, ALAMEDA COUNTY.

Date planted	Yellows on July 8 %	Harvest results, October 27 roots, tons/acre	Harvest results, October 27 sucrose, %
February 13	16	32.6	13.2
March 5	10	33.6	12.0
April 2	5	26.0	13.1
May 1	1	18.6	12.3
LSD, 5%		4.5	0.8

of infection by the beet yellows virus, which is the most severe of the two important yellows viruses. This idea is supported by the observation that yellows symptoms in 1964, though extensive, were not as severe as they have been in other years, and by observation of Detroit Dark Red table beets planted adjacent to the sugar beet plots. Dr. C. W. Bennett of the USDA at Salinas has shown that leaves of this table beet turn dark red when infected with the beet yellows virus. This does not occur when beet western yellows is the only virus present. Based on symptoms on table beets, only about 28% as many plants were infected with the beet yellows virus as were infected with the beet western yellows virus in the 1964 experiment.

The incidence of early yellows infection in beets planted May 1 was about 20%—considerably more than in 1961 and 1962, but only about half what it was in 1963. The nonsprayed May 1 planting produced essentially the same root yield—about 37 tons per acre by late fall—as did nonsprayed beets of the two earlier plantings. The failure of the earlier plantings to produce more than the late one is evidence for yield depression due to the naturally occurring viruses. Additional evidence on this point comes from another date of planting trial conducted near Pleasanton in Alameda County. In this experiment, beets planted in February or March outyielded an April planting by 7 tons per acre and a May planting by 14 tons per acre (table 2). Sugar beets are not overwintered in this area and the incidence of yellows infection was low.

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