Sugar-beet Nematode Activity

yields increased by early planting in sugar-beet nematode infested fields in date-of-planting tests in Monterey County

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Sugar-beet yields of 18.1–22.6 tons per acre were produced in a field heavily infested with the sugar-beet nematode—*Heterodera schachtii* Schmidt—near Salinas when plantings were made in February or earlier. Plantings in March and April produced 6.1–8.8 tons per acre.

The importance of planting date to beet production in sugar-beet-nematode-infested fields was first scientifically indicated in various soil fumigation tests conducted in Monterey County near Spreckels. Generally, the tests showed increases in yields. In plantings made between April 10 and May 20, untreated checks usually averaged 3.1–6.0 tons per acre, and fumigated plots yielded as high as 13.8 tons per acre. However, in one test, the chemicals were applied in November and beets were planted in January and treated and check plots produced an average of about 20 tons per acre.

Further investigations were made with date-of-planting tests conducted on the same field. Sugar beets were planted at monthly intervals in four double-row beds in each of four replicates randomized in four blocks. In every case but one, soil moisture was adequate at planting time or the rows were irrigated immediately after seeding.

Soil temperature records for a location about one mile east of the experimental plot were made throughout the year at a depth of 6″ and included the maximum and minimum daily temperatures.

Two tests were carried out to determine more precisely the effect of temperature on the activity of sugar-beet nematode larvae. Temperature control was obtained by growing sugar beets under greenhouse conditions in containers that were submersed in water in constant-temperature tanks.

In the first test, sugar-beet seeds germinated 14 days in sand at normal greenhouse temperatures were transplanted to sterilized soil in 4″ clay pots. After 14 additional days the plants were removed from the pots and the entire soil and root ball placed in one-half gallon glazed crocks. Sterilized soil was added to fill the crocks to the desired level, to permit selection of test plants for uniformity.

Sugar-beet nematode cysts were recovered from infested soil by wet screening through a 60-mesh screen. The cysts were transferred to small dishes of fresh water in which beet seedlings were placed to induce hatching of the larvae. Larvae were removed daily to ensure freshly hatched specimens. These were counted and added at the rate of 500 larvae per plant. Four holes about each test seedling were made to a depth of about 2″ into the root zone. A water suspension containing the 500 larvae was then introduced, putting about one fourth of the total volume in each hole. The holes were closed by scratching the surface of the soil and irrigating immediately. Five replicates were set up at each temperature, and five uninoculated plants were also included.

The crocks were then placed in the temperature-control tanks and the plants were allowed to grow for 50 days. Then the plant roots were washed free of soil as carefully as possible to avoid dislodging an excessive number of nematodes from the roots. The number of white females on the roots and damp-dry fresh weights of the plants were recorded.

The second test was similar to Test I except that several beet seeds were planted directly into the crocks. Subsequently the plants were selected for uniformity and thinned to one plant per crock. When the plants were about six weeks old, sugar-beet nematode larvae were introduced at two different levels, 500 and 5,000. The plants were grown in the tanks for 53 days and then uprooted and washed free of soil. The numbers of nematodes were too great to be counted directly on the roots. Instead, the roots were placed on a 20-mesh screen held over a 100-mesh screen, and a strong stream of water dislodged the nematodes, which were caught on the finer screen. Lower numbers of nematodes were determined by direct count; higher numbers were computed.

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Average Sugar-beet Yields in Date-of-Planting Tests and Average Daily Minimum and Maximum Soil Temperatures at 6″ Depth

	First year			Second year		
	Yield, tons /acre[a]	Ave. min. temp. °F	Av. max. temp. °F	Yield, tons /acre[b]	Ave. min. temp. °F	Av. max. temp. °F
Jan.	22.6	43	49	20.8[c]	43	50
Feb.	18.6	47	55	18.1	48	55
Mar.	8.8	51	62	8.8	51	59
Apr.	6.1	53	62	8.3	56	65
May		59	70		62	70
June		67	77		68	78
July		67	77		72	80
Aug.		68	77		70	78
Sept.		67	75		70	78
Oct.		63	71		..	..
LSD 19:1	5.1			4.2		
LSD 99:1	7.3			6.0		

[a] Harvest date—Oct. 27, 1955. [b] Harvest date—Oct. 2, 1957. [c] Planted Dec. 29, 1956 to dry soil and first rains occurred Jan. 11, 1957.

Average Fresh Weights of Plants and Sugar-beet Nematode Counts in Temperature Control Test I

Temp. °F	Ave. plant wt. in gms.		Ave. nematode counts from 500 larvae	
	Check	Nematode added	Check	Nematode added
55	49.1	51.1	0	30.4
65	48.9	61.8	0	28.0
75	51.8	65.8	0	421.0
85	45.7	46.7	0	2.4
95	26.4	36.5	0	1.2
LSD 19:1	17.3	13.7		87
LSD 99:1	23.9	18.8		120

Average Fresh Weights of Plants and Sugar-beet Nematode Counts in Temperature Control Test II

Temp. °F	Ave. plant wt. in grams			Ave. nematode counts		
	Check	500 larvae	5000 larvae	Check	500 larvae	5000 larvae
65	105.1	107.2	99.9	0	17	401
70	105.7	91.7	91.1	0	145	4876
75	78.1	83.6	77.5	0	691	4231
80	79.6	78.4	85.9	0	971	5175
85	80.6	63.3	82.7	0	36	756
LSD 19:1	16.0	15.7	13.7	–	404	1526
LSD 99:1	21.7	21.2	18.5	–	548	2067

NEMATODE

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The nematode counts in Tests I and II are comparable, but may be as much as 50% below actual populations because later observations showed that the soil contained about as many females as were attached to the roots when they were washed.

The two tests indicate that the optimum temperature range for sugar-beet nematode larvae is relatively narrow, 70°F–80°F. Activity was significantly lower at 65°F and below and also at 85°F and above. In Test II, where 500 larvae were introduced, the final population level at 70°F was not as high as it was at 75°F and 80°F. Where 5,000 larvae were added, the resulting nematode population apparently exceeded the maximum supportable by the plant size. In this case, plant size rather than temperature limited the population increase, and the final population at above 70°F did not exceed the final population at 70°F.

Unfortunately, in the date-of-planting tests it was not possible to arrange harvest dates to allow each planting exactly the same number of growing days. However, past experience in this experimental plot has shown that beets heavily infested with sugar-beet nematode do not make continued satisfactory growth.

The soil temperature records show that an average maximum of 70°F is not reached in the test area until May; and that it was 77°F–78°F during June. The yield records show that planting dates in January and February were the latest with which 18 tons per acre or more were obtained. With later dates the yields were reduced more than 50%. As the temperature control tests indicate that 70°F is near the minimum requirements for activity of sugar-beet nematode larvae, it appears that sugar beets may become well enough established to produce economical yields if sufficient growth can be made before soil temperatures reach the 70°F level. However, it does not indicate the maximum production in such fields, because the nematode undoubtedly caused some reductions of yields in the early plantings.

The date-of-planting tests indicate that the lower soil temperatures in the early growing season favor beet germination and growth—but not nematode hatching, migration, and invasion of roots—and that 2–3 months of beet growth when soil temperatures are below 70°F results in significant yield increases on nematode-infested land.

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STRAWBERRIES

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paper tore so easily that it was extremely difficult to apply.

Salt accumulation is apparently more of a problem where the beds are not covered than where they are covered. At the end of the harvest season, soils from the various beds compared in the experiments were tested for relative salt concentration. Soils from beds not covered had salt concentrations more than twice as high as the soils from the covered beds. Soil surface evaporation apparently contributes greatly to salt accumulation in raised beds.

The results of these experiments indicate clear polyethylene should be used if early fruit production is desired, but it is doubtful whether the black material should ever be used. On the other hand, perhaps the black is the better material if early fruit production is not important, and weed control is of primary concern.

The use of any of the materials will generally result in a higher gradeout of sound, clean fruit than can be realized from uncovered beds, particularly early in the season when rains are anticipated.

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COTTON

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mean a market for an additional 2.64 million bales of cotton. The 1950–1957 drop reflects in some degree the recession in 1957 and 1958. California and United States cotton growers will get a part of the market back if consumers do restore at least a portion of the cut in per capita use. The fact that rayon and acetate also had per capita use declines in 1956 and 1957 suggests that an important portion of the total decline in United States per capita cotton consumption may reflect the 1957–1958 economic recession.

Even if United States per capita cotton use does not increase from 1957 levels, the projected United States population growth in the 15 years between 1959 and 1975 can mean an increase of 2.5–3.5 million bales in the domestic market for California and United States cotton. The higher cotton use level would be associated with the higher population growth rates. This addition to the market takings would expand further in direct ratio as United States consumers increase their per capita use. Thus the total gains could amount to 4.0–5.5 million bales by 1975.

Growers can be more optimistic about per capita use recovery from the temporary impacts of a recession than about the chances of recovering cotton markets lost to competing synthetic fibers. The consensus of researchers studying cotton marketing and prices is that it is extremely difficult to recover a market for United States cotton, once it is lost, whether the successful competitor is foreign cotton in the foreign market or synthetics in either the foreign or the domestic market.

Cotton growers have already lost sizeable segments of the United States market as industry uses very little cotton now to produce automobile tires, and consumes greatly reduced amounts for bags and containers. Another indication of this problem is that United States production of synthetic fibers increased from the equivalent of about 0.5 million bales in the early 1930's to over 5.0 millions in the middle 1950's—a gain of 10 times—but not all of this growth represents lost cotton markets; much nylon, for example, goes into noncompeting uses. Similar unfavorable long-term shifts also have occurred in foreign markets, where both foreign cotton and synthetics compete with United States cotton.

Price support provisions of the new 1958 cotton legislation offer an important opportunity to cotton growers and the rest of the industry. The expected drop in United States domestic prices will improve the competitive position of cotton relative to synthetic fibers in the United States market. A drop of 3¢–5¢ will make cotton considerably more attractive compared with rayon and acetate, and should aid cotton to share importantly in the increased market demand as population and the national product grow.

Cotton growers should not expect too much increase in market takings in the next few years, however, regardless of lower prices accompanying the currently effective cotton price support program.

Lower domestic cotton prices are essential, however, to enable cotton to get its share in future market expansion. Synthetics will continue to take markets from cotton unless cotton prices are competitive and to be competitive they must be lower than 1958 United States prices. The 1958 legislation promises to lower cotton prices and improve cotton's competitive position in 1959, but the synthetic industry will offer sharp competition in research, efficiency and cost cutting, and market promotion.

United States cotton producers also may be able to obtain a share of market growth in foreign countries, but the immediate prospects for the domestic mar-