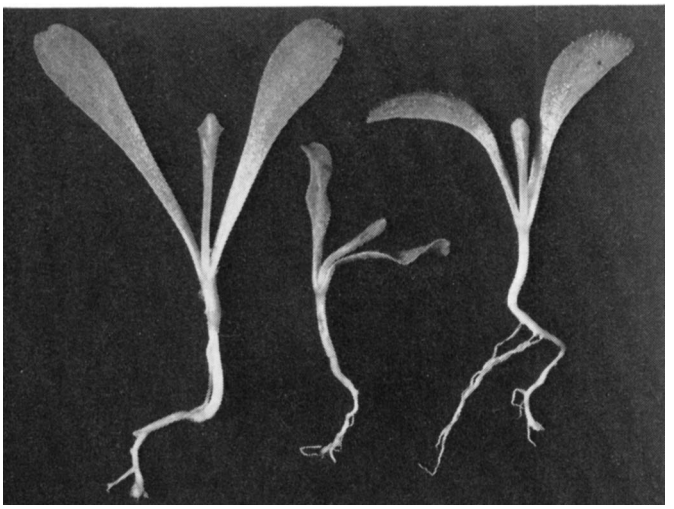

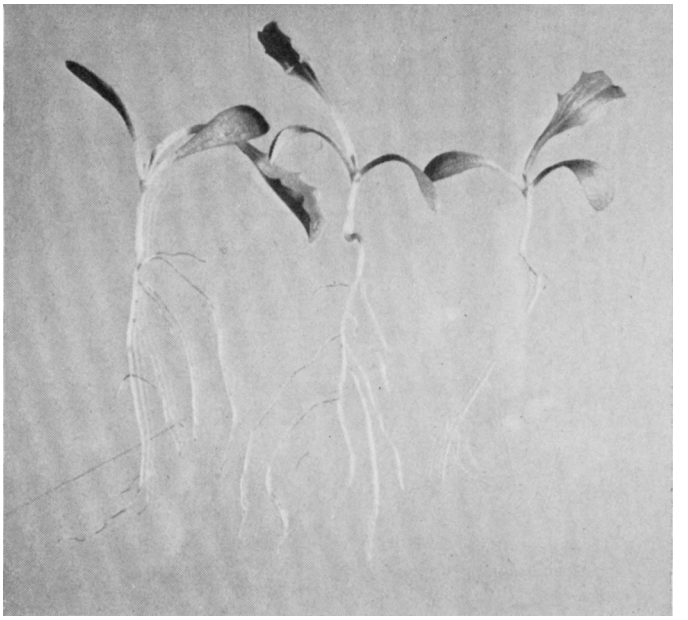

Photo 3 above). Plants grown in nematode infested soil. Photo 4 (right). Plants grown in noninfested soil.

with a 20-mesh screen to separate the coarse debris from the sample and a 150-mesh screen to retain the *L. africanus*. The nematodes were hand-picked from the 150-mesh screenings; washed repeatedly in distilled water and placed in the pasteurized soil (from the same valley fields) in inoculation tubes.

Inoculation chambers consisted of ½ inch-diameter glass tubing, three inches long. Known numbers of nematodes were placed in tubes half-filled with steamed soil. A single lettuce seed of the variety Great Lakes was then planted in each tube. Tubes were embedded in steamed soil in 500 ml Erlenmeyer flasks so that the top of the tube and the mouth of the flask were at approximately the same level (photo 2). The glass tubes were used as chambers within the flasks to concentrate the nematodes nearer the tap roots of the seedlings. Flasks containing the inoculated and the check tubes (same as above but without nematodes) were then placed in five temperature control tanks. Water temperatures were maintained at 55°, 65°, 75°, 85°, and 95°F. Records were kept on the date of emergence of plants from each of the four check and four treated flasks in each of the temperature tanks. Five to seven days after the plants emerged, the inoculation tubes were removed from the Erlenmeyer flasks, the plants were washed and root symptoms observed. Three trials were conducted in the manner described, varying the number of nematodes placed in each inoculation tube. In the three trials five, 20 and 50 adult females were used per tube.

TABLE 1. STATUS OF LETTUCE PLANT DEVELOPMENT FROM DATA COLLECTED BY SAMPLING 15 PLANTS FROM EACH TREATMENT IN EACH OF FOUR REPLICATIONS

Treatments	Mean weight of plants	Mean weight of tops	Mean weight of roots
	gms	gms	gms
	Two weeks after planting		
14 gpa 1,3-D	1.66**	1.54**	.12**
Check	.58	.48	.06
	Seven weeks after planting		
14 gpa 1,3-D	92**	86**	5.6**
Check	35	33	2.5

** Significant at the 1 per cent level.

Photos 3 and 4 illustrate typical results obtained in the pathogenicity trials. Under the experimental conditions, as few as five adult females of *L. africanus* per inoculation tube could produce the disease symptoms in young lettuce seedling roots. The root symptoms appeared identical to those observed under field conditions. Diseased and healthy roots from the pathogenicity trials, as well as those from the field, were preserved for anatomical study.

The disease was not evident in any experiment when temperatures were below 75°F, regardless of the nematode inoculum level. Further work is currently under way to more accurately define the minimum, maximum, and optimum temperatures at which the nematode can reproduce and cause this lettuce seedling disease.

Field control trial

The field selected for the fumigation trial was rotated out of sorghum two weeks before the fumigant was applied. The sorghum stubble had been disked, the field worked, sprinkler-irrigated, and four days later the beds for the lettuce were listed. Beds were formed on 40-inch centers.

Because of lack of time for proper aeration, only one fumigation treatment, 1,3-dichloropropene (DD or Telone) applied at 14 gallons per acre, was injected in the center of the bed with a single shank. Injection depth was 8 to 10 inches below the finished bed. A cultipacker was used to seal the shank marks. Plot size was four beds wide by ⅛ mile in length and the two treatments (14 gpa 1,3-D and the check) were replicated four times. Soil temperature at the point of injection was 75°F, and the moisture content was slightly above field capacity. The soil in this field was 69 per cent sand, 13 per cent silt and 18 per cent clay.

The beds were shaped and planted on precision hills (2 rows of lettuce, 12 inches apart with hills 11 to 12 inches apart in the row) four days after fumigation. Three to four seeds of the variety Climax were planted per hill. The lettuce was hand-thinned approximately three weeks after emergence. No fumigant toxicity was observed. Head weights were obtained by weighing the packed cartons from measured areas of the center two beds. Harvest crew personnel from the ranch did the harvesting and were not informed of the treatments. All plots were harvested three times.

Nematode counts were made by wet washing (with 20- and 150-mesh screens) randomly selected soil and plant samples from the two outside beds of the plots. (This was done to avoid loss of harvest information.) Counts were made by direct observations of the nematodes from the 150-mesh screenings.

Approximately two weeks after emergence, the plants in the fumigated plots

TABLE 2. DATA ON PLANT AND NEMATODE SAMPLINGS FROM THE LETTUCE-LONGIDORUS AFRICANUS FUMIGATION PLOT, IMPERIAL VALLEY, 1967–1968

Treatment	Date of root and nematode sampling	Samples where L. africanus was detectable	L. africanus found per sample	Plants sampled	Tap roots with terminal swelling	Roots forked at maturity
		%	mean no.	total no.	%	%
Check	11/3/67	100	219	289	71.0	
	11/13/67	100	181	806	89.0	
	12/29/67	71	4	**	**	
	2/27/68			10		80.0*
14 gpa 1, 3-D	11/ 3/67	40	36	238	2.0	
	11/13/67	25	50	742	3.0	
	12/29/67	17	1	**	**	
	2/27/68					10.0*

*Twenty-five root systems were examined from each of the two treatments of the four replications.
** No plant samples taken at this date.

TABLE 3. HARVEST DATA FROM THE L. AFRICANUS FUMIGATION PLOT, IMPERIAL VALLEY, 1967–68

Treatment	Heads harvested per replication	Mean hd. weight	Heads harvested
	Av. no.	lbs.	%
	First harveest 1/31/68		
14 gpa 1,3-D	343**	1.12	14.3
Check	42	.90	1.7
	Second harvest 2/12/68		
14 gpa 1,3-D	729**	1.84	30.4
Check	199	1.81	8.0
	Third harvest 2/27/68		
14 gpa 1,3-D	871	1.99	36.3
Check	1549**	1.95	64.3
Total			
14 gpa 1,3-D		7775	81.0
Check		7132	74.0

** Significant at the 1 per cent level.

were more than twice the size of those in the nonfumigated plots (photo 5 and table 1). Lettuce root samples were taken four times during the growing season. The first sampling was two weeks after planting; the second, seven weeks after planting; the third, nine weeks after planting, and the fourth at final harvest (tables 1 and 2).

The percentage of tap and lateral roots displaying the disease symptoms found in the first two samplings and the percentage of forked roots on mature plants are listed in table 2.

Nematode counts

Nematode counts were made three times during the course of this trial. The first two were made from soil collected with the plant root samplings described above; the third count was made from soil samples collected when the plants were approximately two months old. The effects of the fumigation treatment on nematode population levels at the three sampling dates are also presented in table 2. Wherever nematodes were found in either the fumigated or nonfumigated treatments, tap and lateral roots displayed gall symptoms. The lettuce was harvested three times and the results of the harvests are presented in table 3. Big Vein disease was present in the field and was evaluated when the plants were two months old and again at maturity. The severity of the disease was equal in both the fumigated and nonfumigated treatments.

Greenhouse pathogenicity

Greenhouse pathogenicity experiments and the results of the preplant fumigation trials have demonstrated that *L. africanus* is a pathogen of head lettuce in the Imperial Valley of Southern California. Controlled temperature work has initially indicated that only when soil temperatures are above 75°F will the nematode be of economic importance. This evidence is further supported by the low nematode population levels found in the last samplings of the field trial where average soil temperatures were below 70°F. The importance of *L. africanus* as an economic pest will depend in part on the planting date, and the soil temperatures during the growing season.

Twice growth

During the first two months of growth, plants in the fumigated plots were more than twice the size of the plants in the checks, and the fumigation treatment resulted in a much earlier plant maturity. Head size in the first harvest was small because of climatic conditions; however, the lettuce growing in the fumigated soil still produced heavier heads. Temperatures in the Valley during the last month of the growing season were abnormally high, allowing lettuce in the check plots to mature sufficiently for a third harvest. Under normal Valley growing conditions the total yields would have included only the first two harvests reported and the impact of preplant soil fumigation would be even more striking.

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Photo 5. Plots in front of and behind the farm advisor were fumigated. The four-bed plot in which he is positioned is a nonfumigated check.