

Soil Fumigation Work in 1947

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SOIL FUMIGANTS were applied to about 700 acres of land prepared for sugar beets in the intermountain region in 1947, for the purpose of controlling the sugar beet nematode, *Heterodera schachtii* Schmidt. These applications were generally successful and satisfactory crops of sugar beets were produced on the majority of the fields. However, there were a few fields from which the yields fell far short of those anticipated and these failures again emphasize that soil fumigation is a technical process which must be carried out by well-equipped, competent operators, on soil which is in proper condition from the standpoint of tilth, moisture, temperature, and fertility. It is not at all surprising that occasional applications have been unsatisfactory when we consider that this was only the third year that field-scale fumigation has been practiced in this region, and certain technical aspects of the process still demand additional research. When we compare our success in soil fumigation with that of early work on insecticides and fungicides, it is evident that excellent progress has been made in the relatively brief period since commercially feasible products have been available.

Certain fumigated fields in the Lewiston, Utah, district presented the most serious problem experienced to date in the intermountain region. Applications were made from April 5 to 15 and immediately afterward about 3 inches of rain fell which, combined with the high water table of that section, practically submerged certain fields. As a result, 43 acres were classed as unsatisfactory and produced only an average of 12.9 tons of beets per acre. However, when we consider that these fields had produced beets in 1946 and were heavily infested with nematodes, these yields compare favorably with the district average of 13.0 tons per acre on untreated fields.

Unsatisfactory yields on these few fumigated fields of the Lewiston district doubtless were due to the excessive moisture content and lack of aeration of the soil. This is indicated by the fact that two fields in this general area, which were disked up and replanted after the flooding, because of poor stands, produced 15.5 and 17 tons per acre, respectively.

In contrast to the generally good results secured in the intermountain region there have been numerous reports of unsatisfactory yields from the fumigated fields in California. Apparently our success has largely been due to a combination of the following factors, one or more of which have not been applicable to the large-scale farming operations of that state:

1. Close supervision by the sugar company field men who have insisted that chemicals be applied only when fields are in proper condition.

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2. Small acreages which enable the owners to prepare them at the proper time and have them fumigated before excessive drying occurs.

3. High fertility of the fields after carefully planned crop rotations and the application of barnyard manure and commercial fertilizers.

4. Availability of applicators which make it possible to cover the fields at the proper time. Both chisel and plow-sole types of applicators have been built by the local sugar companies, generally on the growers' own tractors.

Typical of the yields secured from fumigation with 25 gallons of D-D per acre are the following data from the Smithfield, Utah, district:

Crop succession	Acres	Tons per acre
Beet following beets	6	19.4
One year between beet crops	3	22.0
One year between beet crops	6	17.0
One year between beet crops	1	20.0
One year between beet crops	8	20.0
District average on untreated land		14.5

Two Successive Sugar Beet Crops Produced with Fumigation

Two fields on which sugar beets have been grown 2 successive years following fumigation each year gave the following yields:

Application	Tons per acre			
	Fumigated 1946	Fumigated 1947	Untreated check 1946	Untreated check 1947
25 gallons D-D per acre (No fertilizers applied in 1947)	21.09	15.5	2.0	2.0
Part 25 remainder 50 gallon D-D 1946, 25 gallon 1947	22.0	16.0	5.0	0

A check strip through the portion on which 50 gallons per acre were applied in 1946 was practically devoid of sugar beets, proving that even this heavy rate of application will give only 1 year of control of sugar beet nematodes on these old, severely infested fields.

Comparative Experiments with D-D and Dowfume N

Data from fields which were fumigated, part with D-D and the remainder with Dowfume N, at the rate of 25 gallons per acre showed that these 1,3-dichloropropene mixtures are practically identical in their efficacy:

Crop succession	DD	Tons per acre	
		Dowfume N	Unfumigated check
Beets following 5 years alfalfa	16.4	16.6	15.5
Beets following beets	19.79	19.79	6.0

It will be observed that approximately 1 ton per acre was added to the yield of the first field by fumigation, showing that even after long crop rotations there frequently is a considerable loss from surviving nematodes.

Beets from the untreated checks of the second field came largely from one end of the field where no nematodes were present, the infested portions being practically bare. Top growth of the beets on the fumigated areas was unusually vigorous and throughout the season there was a conspicuous difference between them and the tops of the uninfested portions of the check strips; an excellent demonstration of the "stimulation" frequently observed on fumigated soil. Sugar content of 5 samples, each containing 10 beets, from each of the 3 areas, gave 16.2 percent for both the D-D and Dowfume N and 15.4 percent for the untreated check.

Comparative Yields from Crop Rotation and Fumigation

A field near Ogden, Utah, which was broken from alfalfa in 1945 was planted in 1946, part in sugar beets and the remainder in potatoes and corn. The beet yield was estimated at over 25 tons per acre. The entire field was planted in beets in 1947 after the 1946 beet portion was fumigated with 25 gallons of D-D per acre, except for a narrow check strip. Following are the 1947 yields:

Crop succession	Tons per acre
Beets following alfalfa, potatoes and corn	28.13
Beets following beets after fumigation	28.17
Beets following beets, unfumigated check	0

The excellent results secured during the first year following crop rotation are well illustrated in this field, while the futile attempt to produce a second crop without fumigation is demonstrated by the untreated check strip which was practically devoid of beets.

Fumigation for Control of Sugar Beet Root Maggots and Root Aphids

A field severely infested with sugar beet root maggot, *Tetanops aldrichi* Hendl., and sugar beet root aphids, *Pemphigus betae* Doane, was fumigated with Dowfume W10 (10 percent by volume of ethylene dibromide in a petroleum thinner) at the rate of 25 gallons per acre. For this purpose a chisel-type applicator was used which had been adjusted to apply side-dressings of liquid fertilizers. The chemical was applied about 5 inches deep at a distance of 6 inches from each side of the row but, unfortunately, 25 gallons per acre were injected instead of the 20 gallons intended. The root maggots and aphids were completely killed out but considerable injury was caused to the beets roots, with an occasional plant dying. A lower dosage would probably have been just as efficient with less damage to the root system.

Chisel-type applicators mounted on the tool bars of tractors are ideal machines for applying liquid fertilizers like phosphoric acid and the residues from ion exchange batteries of the sugar factories. It may even be possible to apply some of the new insecticides mixed with the fertilizers for control of wire worms, white grubs and root-infesting insects as mentioned above, thereby making more extensive use of these machines.