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06219

United Nations Industrial Development Organization

Distr.
LIMITED
ID/WG. 184/13
23 December 1974
Original: ENGLISH

Symposium on the Development of the Plastics Industry in Latin America

Buenos Aires, 8 - 17 September 1974

SOIL FUMIGATION IN CALIFORNIA-1974 1/

by

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SOIL FUMIGATION IN CALIFORNIA-1974

SUMMARY

Acreage of Methyl Bromide and Chloropicrin combinations, or each chemical for a specific problem, has increased from 15,000 to 22,000 in California. Methyl Bromide and Chloropicrin are the main chemicals used in soil fumigation with tarps in California.

Special equipment has been developed to inject deep dosages for special crop problems as well as greenhouse, nursery treatments, preplant trees and vine crops. (Fig. 1 and 2). Over 50 percent of the fumigation is now tarped with glue, sealing one sheet to the other. Thicker polyethylene tarps are used to retain the gases, and reduced dosages can be used in offsetting some of the plastic costs.

A new additive to Methyl Bromide Chloropicrin forms a gel when the gases contact the air. This characteristic allows the elimination or reduction of the plastic tarp thickness, depending on the problems of the area and surroundings. Some bromine sensitive plants may be treated with Methyl Bromide or combinations with Chloropicrin or nematocides, provided adequate leaching of the soil is practiced prior to planting.

The entire crop of strawberries is treated prior to planting for diseases, weeds, and pest control in California.

A new strain of Alternaria sp. has been retarded in its infection of tomato plants by combinations of Methyl Bromide and Chloropicrin fumigation.

The tobacco plant bed acreage is treated with these fumigants in the USA. A heavy protein foam is in an experimental stage that seals the soil injected chemicals similar to plastic tarp.

INTRODUCTION

Where many changes in soil fumigation are being made, an evaluation of tarp thickness, different dosages, and the new Agel formulations of Methyl Bromide and Chloropicrin was made on staked tomatoes started under plastic row covers in the early spring crop. Trials for two years, 1972 and 1973, were conducted, and detailed yields were taken in the 1973 plantings. The results are given in this report.

MATERIALS AND METHODS

The 1972 trials comprised field sections where two dosages of Methyl Bromide and Chloropicrin (67-33) were compared with the regular (350 pound) dosage of the same mixture with one and one and a half mil thickness plastic tarp on December, 1971. The soil series was Foster fine sandy loam, and the hybrid #6718 was planted into the field with these treatments.

Another field had two dosages, 350 and 425 pounds, per acre of the same fumigant. In this field the same hybrid #6718 was highly tolerant to the Alternaria sp. that had been attacking the susceptible tomato varieties in the area. Another variety, Grand Pak, that is susceptible to this disease was planted in a section of each field strip that was observed for plant response. These two strips were tarped with one mil, clear plastic. These plots were treated on December 16, 1971. The plants of these two treatments were transplanted on February 15, 1970 in Palm City, California.

Harvest started in June and continued into August. In all of these treatments the standard 11 foot tractor-drawn applicator injected the chemicals to a 6- to 8-inch depth and the tarp was applied to cover the soil. This clear plastic was a solid application with each sheet glued to the strip laid down before and adjacent to the one being treated. The plastic cover was left on from one to two weeks before removing.

Another trial in the 1972 crop was tested, except the two ends of the tomato field. This field was treated with 200 pounds per acre of 67-33 Methyl Bromide and Chloropicrin mixture in October, 1971. The highly tolerant hybrid #6718 was planted into the field on January, 1972. This field, like the other trials, was solid tarped with one mil, clear plastic. This field trial was conducted by the Jaekel and Rogers Ranch in Chula Vista.

The third trial was conducted on Iwashita Bros. Ranch in Chula Vista. Twelve strips or 2½' x 200' were treated on August 22, 1972, on a soil series, Alliso fine sandy loam. This land, like the other trials, had frequent plantings of tomatoes and other vegetables. This field was rotated with cucumbers started under plastic row covers as were the tomatoes. On these trials the susceptible variety, Grand Pak, was planted in one or two rows with 60 plants per row in each treatment, including two check strips. The rest of the strips were planted to the hybrid #6718 on January 27, 1973. Besides the two Methyl Bromide and Chloropicrin, 67-33 and 45-55 percentages, the Agel formulation of 67-33 mixture was compared. These two varieties gave a double evaluation of both yield and disease occurrence and development during the plant growth. The following fumigation treatments were conducted in field trials on the Iwashita Farms in 1973:

Chart 1

1973 SPRING TOMATO SOIL FUMIGATION
IWASHITA BROS., RANCH

Chemical - % Methyl Bromide	Chloropicrin	Form	Dosage	Tarp Thickness	Varieties Planted
67%	33%	Regular	300	1½	(Grand Pak &
67%	33%	"	200	1½	#6718)
67%	33%	"	400	1½	"
Check	-	-	-	-	#6718
45%	55%	Regular	200	1½	(G.P. & #6718)
45%	55%	"	300	1½	"
67%	33%	Agel	150	1	"
67%	33%	"	200	1	"
67%	33%	"	250	1	"
Check	-	-	-	-	#6718
67%	33%	Regular	300	1	"
67%	33%	"	300	1½	"

RESULTS

The first two trials on the Egger-Shio Ranch resulted in two important observations. First, the high dosage of 425 pounds per acre with the one mil caused 1/4 to 1/3 plant stunting and a yield decrease in relation to the plant size. The regular dosage of 350 pounds per acre of 67-33 mixture with 1½ mil also caused a plant stunting and yield reduction compared to the [illegible] dosage of one mil terp thickness. The Alternaria sp. disease was apparently delayed by the fumigation but did not control it on the susceptible Grand Pak variety.

The second trial on Jaekel and Rogers Ranch that was planted to the hybrid #6718 on January 24, 1972, and the field was treated except the 20 to 30 feet of each end. This showed little plant difference until midway through harvest. At this time the plants began to show lack of vigor. By the end of harvest the non-fumigated strips showed plant stunting, with a light infection of Alternaria sp. (Fig. 3). This demonstrated the value of fumigation on this field frequently planted to tomatoes.

Chart 2 shows the yield per acre results of the three doseges of 67-33, compared with Grand Pak and hybrid #6718, as well as the percent of the Alternaria sp. development and the weed counts.

Chart 2. YIELDS IN TONS/A OF 3 RATES OF METHYL BROMIDE-67%, CHLOROPICRIN-33% FUMIGATION - IWASHITA BROS. RANCH

	200 Lbs/A 1½ Mil Terp		300 Lbs/A 1½ Mil Terp		400 Lbs/A 1½ Mil Terp		Check -	
	Grand Pak	#6718	Grand Pak	#6718	Grand Pak	#6718	Grand Pak	#6718
Yields thru May	8.7'	11.8'	9.6'	9.4'	8.1'	12.2'	7.6'	8.2'
Yields thru June	29.3'	26.2'	26.7'	23.3'	26.5'	26.1'	22.2'	21.5'
Total	34.8'	38.4'	35.5'	35.8'	35.0'	38.1'	27.9'	29.1'
% Disease in May	22.5	-	27.5	-	17.5	34.17		
Grand Pak in June	62.5	-	62.5	-	50.83	76.67		
End of Harvest	96.66	-	96.66	-	100.00	100.00		
No. of Weeds per Square Foot	2.2		1.2		3.0		81.2	

All treatments increased yields compared to the untreated. The 200 pound dosage with the 1½ mil terp yielded as well as the other higher dosages. Weed control was just as good.

The third trial of Iwashita Bros. 1973 spring tomato crop developed some interesting results. Yields were taken usually twice weekly and box counts per two center rows of each treatment were recorded. Also, starting in April, when the Alternaria sp. disease started to appear, the number of plants showing disease were recorded on a two week schedule.

The results of the combination of 200 and 300 pounds per acre of 45-55 Methyl Bromide and Chloropicrin, as well as the disease and weed count are given in Chart 3.

Chart 3 1973 METHYL BROMIDE-45% AND CHLOROPICRIN-55% MIXTURE FOR FUMIGATION - IWASHITA BROS. RANCH

Yields thru	200 Lb. Grand Pak	200 Lb. #6718	300 Lb. Grand Pak	300 Lb. #6718	Check Grand Pak	Check #6718
May	7.3	10.6	7.4	11.5	7.6	10.2
June	25.0	30.9	24.0	26.8	22.2	21.5
Total	31.4	33.1	31.3	38.6	27.9	29.1
Dis.Incid.May	17.5		20.83	-	34.17	-
" " June	57.5	-	48.33	-	76.67	-
" End of Crop	100.00		95.00	-	100.00	-
# Weeds/Sq.Ft.	2	0	0	9	81	2

The 45-55 mixture did not yield quite as well as the 67-33 mixture shown in Chart 3. It appeared that the higher Chloropicrin may have slightly delayed the Alternaria sp. disease infection. The weed control was similar for the two dosages.

Where plastic tarp costs have increased, the comparison of 1 and 1½-mil thickness was made, along with the untreated soil in yield and weed and disease incidence as is shown in Chart 4.

Chart 4 SOIL FUMIGATION OF 67-33 METHYL BROMIDE CHLOROPICRIN FORMULATION WITH 1 VS. 1½ MIL PLASTIC IWASHITA BROS. RANCH

Yields thru	300 Lb/Acre 1 Mil Plastic Tarp Grand Pak	300 Lb/Acre 1 Mil Plastic Tarp #6718	300 Lb/Acre 1½ Mil Plastic Tarp Grand Pak	300 Lb/Acre 1½ Mil Plastic Tarp #6718	Check Grand Pak	Check #6718
May	13.3	13.6	9.6	9.4	7.3	10.8
June	32.1	33.4	26.7	23.3	20.7	22.8
Total	49.0	49.8	35.5	35.3	25.7	30.1
Dis. Incid.May	30.0		27.5		32.8	
" " June	42.0		62.5		55.00	
Total	96.67		100.00		100.00	
Weeds per sq.ft.	7	5	1	2	81	2

The yields indicated that a one-mil plastic is sufficient for a 300 pound dosage. If a 1½-mil tarp is used, dosages can be reduced for equal yield and disease control.

The new formulation, Agel, of 67-33 combination, resulted in good yields for both of the two varieties tested. See Chart 5. For the hybrid #6718, the three dosages 150, 200 and 250 pounds per acre resulted in similar total yields and much higher then the untreated plots. Similar weed control was obtained, yet the higher dosage had a slight tendency to miss a few more resistent weeds such as malva. The lower 150 pound dosage on the Grand Pak variety gave slightly more favorable yields then the 200 pound dosage. As in all cases, the untreated plots resulted in much lower yields of both varieties. (Fig. 4).

Chart 5 YIELDS OF AGEL FORMULATION OF 67% METHYL BROMIDE & 33% CHLOROPICRIN MIXTURE

	150 Lbs/A		200 Lbs/A		250 Lbs/A		Check	
Yields thru	Grand Pak	#6718	Grand Pak	#6718	Grand Pak	#6718	Grand Pak	#6718
May	10.3	10.3	8.1	11.1	-	11.7	7.1	11.4
June	38.2	29.9	30.8	30.3	-	30.1	19.3	24.0
Total	53.0	43.5	43.2	44.0	-	43.1	24.5	31.1
Dis. Incid. May	26.7	-	20.00	-	-	-	43.3	-
" " June	50.0	-	48.33	-	-	-	53.33	-
" " Total	100.00	-	98.33	-	-	-	100.00	-
# Weeds/sq.ft.	15		25		56		81.2	

CONCLUSION

Fumigation materially increased tomato yields on both the Grand Pak and #6718 hybrid, compared to untreated trials.

High dosages of Methyl Bromide and Chloropicrin had a plant stunting action on the Grand Pak and #6718 hybrid. The tolerant variety, hybrid #6718, resulted in a yield increase over the susceptible variety, Grand Pak, in the untreated plots. Also, both varieties had good yield increases with all the soil fumigation treatments. The 45-55 Methyl Bromide-Chloropicrin treatment did not increase the yields as much as the 67-33 mixture. The 45-55 mixture had a greater tendency to slightly delay the Alternaria sp. disease appearance in the Grand Pak variety. The 300-pound dosage of 67-33 fumigant comparing one and one and a half mil plastic tarp showed another relationship. The thicker 1½-mil plastic retained the soil fumigants more effectively than 1 mil. This means that dosages can be reduced with similar disease, weed, and pest control results. This also indicates an application cost reduction.

The Agel formulation of 67-33 Methyl Bromide-Chloropicrin resulted in increased yields of both Grand Pak and hybrid #6718 over non-fumigated trials. Lower dosages on this

material resulted in similar yields as the higher dosages, indicating an advantage of reducing dosages and material costs. Also, as the gas forms a gel on contacting the soil and air, a thinner tarp can be used to cover it. None of the fumigation combinations or materials controlled the Alternaria sp. disease; they delayed the infection where a fairly good portion of the Grand Pak variety crop could be harvested before the major portion of the plants were infected.

In early spring row cover crops, where the land is frequently reused for the same crop such as tomatoes, the disease, pests, and especially weed control, are very essential in reducing production costs, and Methyl Bromide-Chloropicrin fumigation has effectively controlled them.

APPRECIATION

Appreciation is expressed to the three growers conducting these trials: Egger and Ghio, Jaekel and Rogers, and Iwashita Bros., Chula Vista; to Great Lakes Chemical Corporation for supplying the new Agel mixture; Grove Chemical Company; Tri-Cal Company for applying the field tests; and to John Johnson and Larry Dotterman, field technicians, who assisted in conducting these trials.

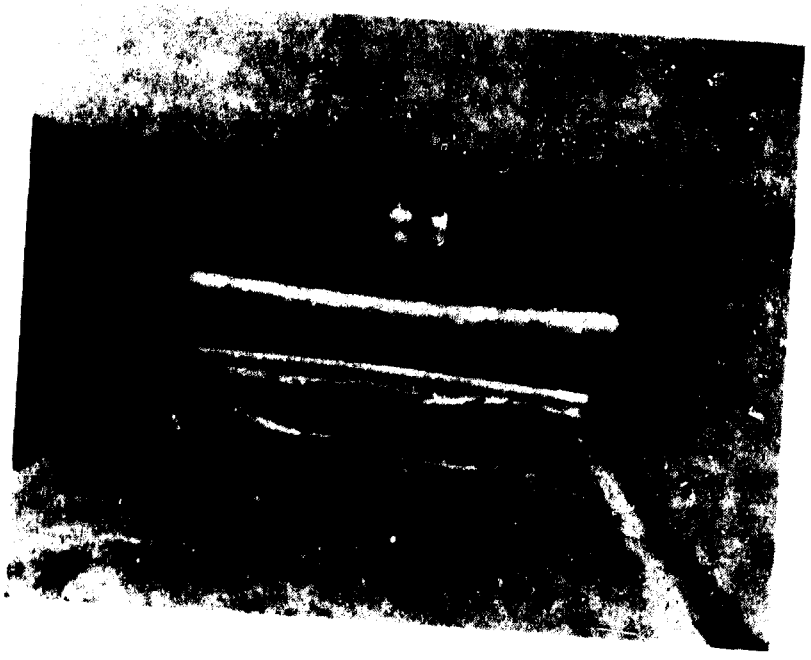


Fig. 1. Solid tarp soil fumigation equipment injecting chemicals, and plastic tarp laid behind injector shanks.

Fig. 2. Plastic tarp puller removing plastic from treated field.

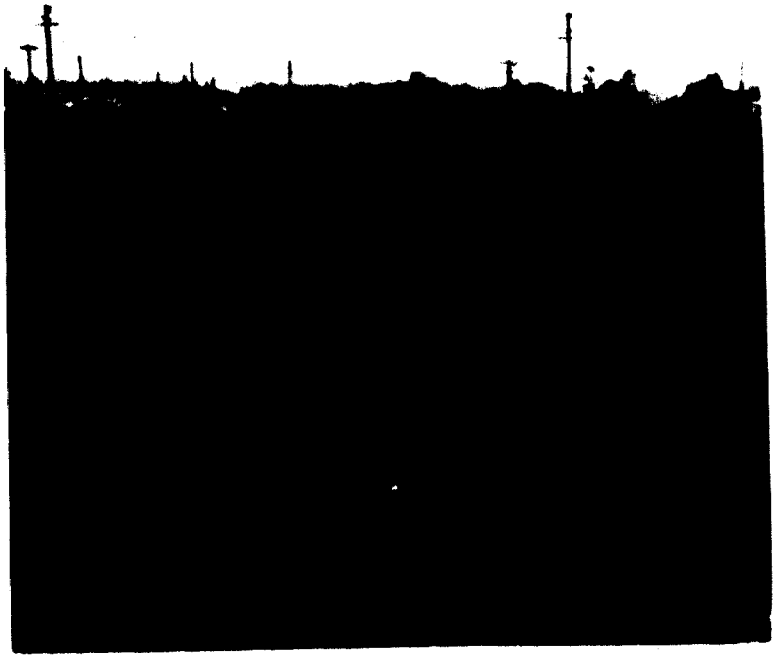


Fig. 3. 1972 tomato fumigation with 67-33 on #6718 hybrid on left, and untreated strip on right at end of harvest at Jaekel & Rogers Ranch.

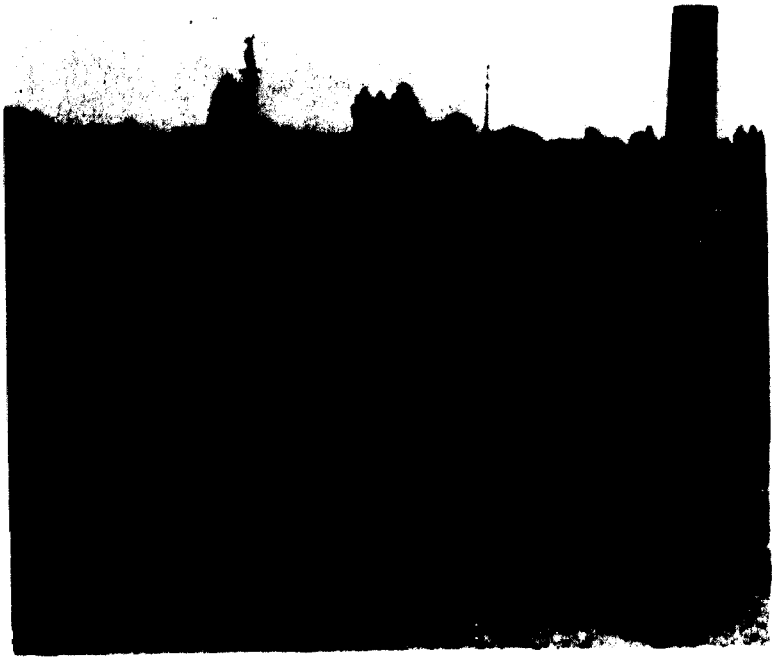
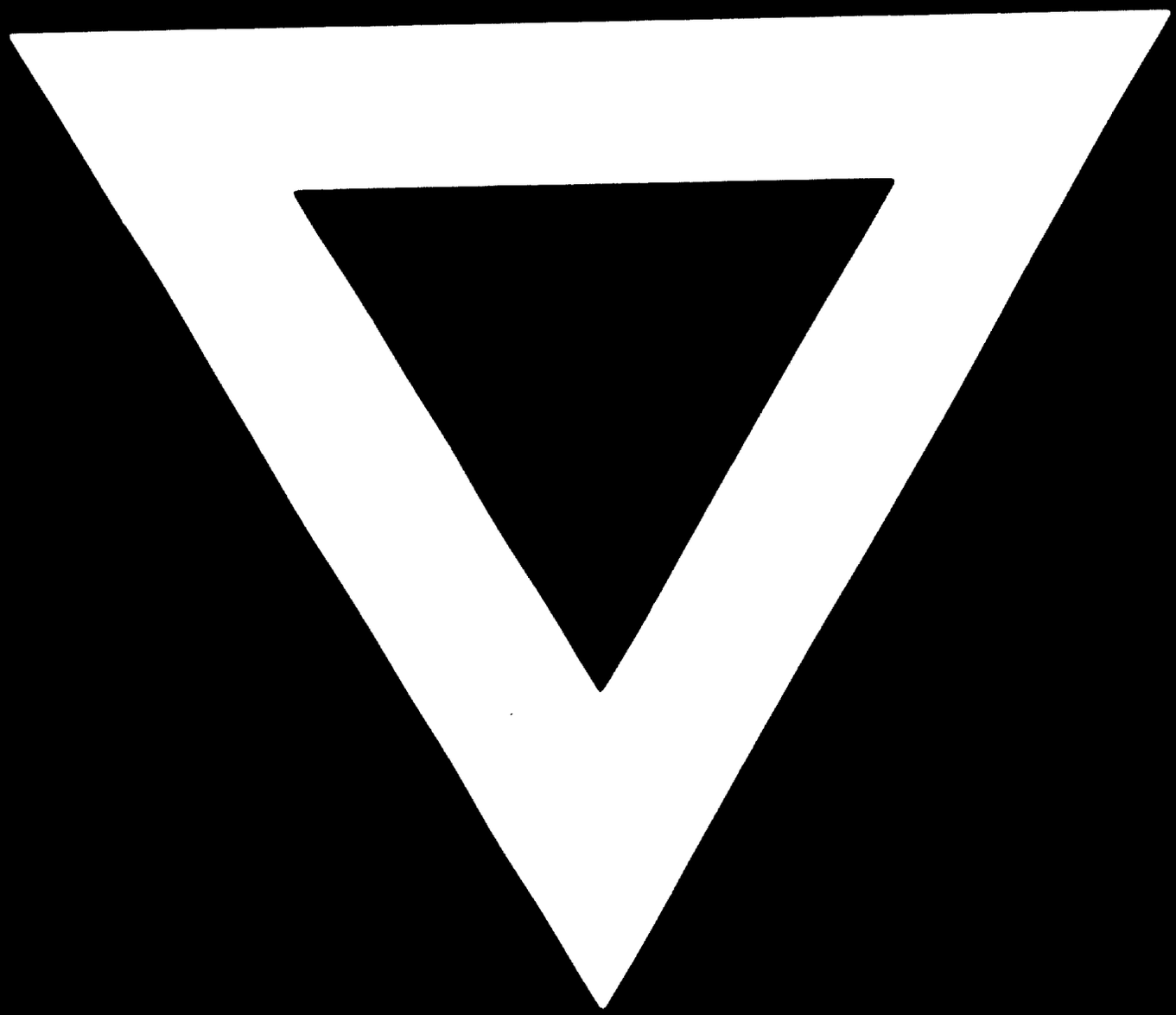


Fig. 4. Untreated Grand Pak tomato variety on right, and #6718 hybrid in center. On left, row has been fumigated with Agel 67-33 mixture at Iwashita Bros. Ranch.



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