IMPACT OF TOWNSHIP CAPS ON TELONE USE IN CALIFORNIA

Tom Trout, USDA-ARS, Fresno, CA

Telone (1,3-dichloropropene) is a soil fumigant and effective nematicide. It has successfully been used, alone or in combination with other fumigants such as chloropicrin, as an alternative to methyl bromide for both perennials and annual fruits and vegetables. About 25 millions pounds of 1,3-D per year were used in California in the 1980s before it was taken off the market in 1990. It's use in California has increased from essentially zero in 1995 when it was reintroduced, to 7 million pounds in 2003. It has been used primarily for planting a variety of perennials and for annual root crops (sweet potato, potato, and carrot). It is marketed as Telone II® (94% 1,3-D), Telone C-35 (61% 1,3-D and 35% Chloropicrin) and Telone C-17 (84% 1,3-D and 17% Chloropicrin). Emulsified 1,3-D products, InLine® (emulsified Telone C-35) and Telone II EC (emulsified Telone II) for application through drip irrigation systems, were registered for use in CA in 2001, and were used on about 5500 acres of strawberries, melons, and peppers in 2003.

Telone Use Restrictions in California

Due to emissions associated with 1,3-D soil application, state *Permit Conditions* (established by the Ca Dept. of Pesticide Regulation (DPR)) limit applications depending on the application method, location, and time of the year. Field workers are required to wear personal protective equipment including respirators and field and buffer zone re-entry is restricted for 7 days. During December and January, application methods are restricted and application factors used to calculate township caps are increased.

Buffer Zones: The buffer zone for Telone products in California varies from 300 ft to 100 ft, depending on the product and frequency of use. A residence located on the border of a field prohibits application to about 3 ac. around the residence with a 300 ft buffer and 1/3 ac with a 100 ft buffer. An aerial survey of a rural perennial crop area in south-eastern Fresno County showed an average of 19 residences restricting use on each square mile section (640 ac.) of land. About 100 cropped acres or 16% of cropped land fell within the 300 ft buffer zone and could not be fumigated. With a 100 foot buffer, only 10 cropped acres or 2% of the total cropped land was impacted. The impact will be greater in heavily populated coastal areas, and less in sparsely populated areas.

Township Caps: The California *Permit Conditions* allow only 90,250 "adjusted" pounds of 1,3-D (9600 gal of Telone II) be applied to any "township" in a calendar year. Townships are 6 mi x 6 mi areas (23,040 ac) defined by township and range designations. Adjusted pounds is the actual pounds of 1,3-D applied

times the “application factor” (AF) specific to the application method. Application factors are (for the Feb. - Nov. time period):

1.0 for shank applications deeper that 18 inches
1.9 shank applications shallower than 18 inches
1.16 drip applications of *Inline* under plastic mulch

These township caps result in maximum acreage use per township of:

273 acres (1.1% of land in a township) with deep shank application at 330 lb/ac (perennials),
560 ac. (2.4% of land) with shallow shank application at 85 lb/ac (vegetables)
480 ac. (2.1% of land) with drip application at 250 lb/ac in the bed (strawberries)

In 2002, DPR issued a *California Management Plan for 1,3-D* in which they allow township caps to double (to 180,500 lb) temporarily. This was based on the chronic nature of the risks and the fact that use since 1995 has been gradually increasing. Townships are given credit for their unused (banked) cap allowances since 1995 and use the credits to double the cap allowance. Thus, if a township used no Telone for the 6 years before 2002, they could use 180,500 lb per year for the next 6 years.

Impact of Township Caps

To assess the impact of township caps on potential Telone use in California, the Calif. Dept. of Pesticide Regulation Pesticide Use Report (PUR) database was used to determine the geographical distribution of past fumigant use. From these data and assumptions about application rates and methods, limitations to converting to Telone use on those fields were projected. Acreage fumigated with methyl bromide or chloropicrin in each township for each crop was determined. It was assumed that present use of metam sodium (Vapam) would not convert to Telone, and that crops not currently being fumigated would not use Telone. The “adjusted” pounds of Telone that would have been used on this fumigated area in each township were calculated using assumed application rates and methods for each crop (Table 1). This potential use was added to actual Telone use in the township. Then, for those townships where the Telone cap was exceeded, the excess was divided among the crops based on the proportional area of each crop fumigated in the township. This procedure assumes all crops presently fumigated with MeBr, chloropicrin, and Telone will use Telone when MeBr is no longer available. It also assumes all crops will have equal access to Telone and no evaluation was made of which crop might get priority use of the product in the township.

Table 1. Application rates and factors used in the township cap analysis.

Crop	Application Rate	Application Factor	Application Method
	lb/ac		
strawberry (broadcast)	330	1.9	Shallow Shank, broadcast
strawberry (bed shank)	330 x .65	1.9	Shallow Shank, bed
strawberry (drip)	250 x .65	1.16	Drip, bed, HDPE mulch
pepper	85	1.9	Shallow Shank, broadcast
cole crops	85	1.9	Shallow Shank, broadcast
leafy vegetables	75	1.9	Shallow Shank, broadcast
melons	70	1.9	Shallow Shank, broadcast
vegetable - misc	85	1.9	Shallow Shank, broadcast
tomato	100	1.9	Deep Shank, broadcast
potato, sweet potato	120	1	Deep Shank, broadcast
carrot	100	1	Deep Shank, broadcast
fruit and nut trees	330	1	Deep Shank, broadcast
grape	330	1	Deep Shank, broadcast
nursery - outdoor	330	1	Deep Shank, broadcast
nursery - greenhouse	330	1	Deep Shank, broadcast
cut flowers	330	1	Deep Shank, broadcast
ornamental	330	1	Deep Shank, broadcast
field crops	85	1	Deep Shank, broadcast
misc agri	330	1	Deep Shank, broadcast

Table 2 shows the impact of the township caps for the fumigated crops in California based on the 2003 PUR data. The table shows current Telone use, the acreage that could potentially use Telone (current MeBr or chloropicrin use) and the acreage that would exceed the caps for both the standard (1X or 90,250 lb) and doubled (2X or 180,500 lb) caps. It also shows the current, potential and allowed Telone use. Thirty percent of the area fumigated with Telone, MeBr, or chloropicrin (and potential Telone use) in CA exceeded the 1X caps and could not be fumigated with the material. Doubling the cap reduces the excluded acreage to 16%.

The potential uses, and thus use limitations, are distributed very unevenly among crops and counties. The largest impact by far is on strawberries, and the counties in which strawberries are grown (Monterey, Ventura, Santa Barbara, Santa Cruz, and Orange) and other crops grown in the same areas (bushberries, cut flowers, nurseries, peppers, other vegetables). The second most impacted crop is sweet potato, because most of the fumigated acreage is concentrated in 4 townships in Merced County. Telone use in processing tomato is increasing, and may be impacted by the caps. Substantial methyl bromide is used for watermelons and cantaloupe, although metam sodium is now used on more acres than MeBr. Nursery fumigation is also severely impacted by the caps, again because nurseries are concentrated in particular townships (strawberry nurseries, rose plant nurseries), or in areas with strawberries. Perennial crops have only a moderate amount of impact with the 1X cap (about 15% of acreage) and little impact with 2X cap, because the orchards and vineyards within a township are replanted, and

thus fumigated, only every 7 to 30 years. Another report - "Fumigant Use in California" summarizes use of all fumigants by crop in California over the last 8 years.

Table 3 shows the potential cap impact by county. The greatest impact is on coastal counties with large strawberry acreage, and Merced County where sweet potato is grown. The map shows the locations of townships where caps are most likely to limit use (based on the above assumptions). Notice the concentration in the coastal valleys where strawberries are grown.

Township cap analysis was also carried out on the PUR data for 2000 which was prior to substantial impacts of the MeBr phaseout, and when Telone use was fairly small. The analysis showed lower impacts of the Cap - 21,000 (26%) and 9000 (11%) excluded acres with 1X and 2X Caps, respectively. Increased impacts in 2003 were generally related to increased acreage for particular crops. For example, in 2000 when total fumigated strawberry acres was 22,300, 11,791 ac (53%) and 6569 ac (29%) exceeded the 1X and 2X Caps, respectively. Of the 4855 ac (22%) strawberry fumigated acreage increase from 2000 to 2003, 80% exceeded the 1X Cap 65% exceeded the 2X Cap, because strawberries are grown in concentrated areas and all additional acres in a "Capped" township will exceed the Cap. For almonds, which are more dispersed, a fumigated acreage increase of 4000 ac resulted in an additional 1100 ac potentially exceeding the 2X cap.

The 2X Cap can be used in a township until the average use since 1995 exceeds 90,250 lbs per year. Table 4 lists the townships that have had the highest cumulative use from 1995 to 2003 and the remaining years of 2X Caps. Four townships are in jeopardy of using up the banked allowance by 2005. Two of those townships are in Merced County where the primary fumigated crop is sweet potato. Most townships had at least 4 years of 2X Cap remaining in 2003. Table 4 also lists the current and potential use in each township where there is potential to exceed 90,250 lb/yr.

Table 2. Township Cap Limitations on Telone Use in California by Crop. (Based on 2003 CDPR Pesticide Use Report data. Assumes all crops that presently use MeBr, Chloropicrin or Telone will convert to Telone. Based on application rates and factors in Table 1.)

Crop	2003 Use Telone	2003 Use MeBr	Total	Area that cannot use Telone 1X Cap		Area that cannot use Telone 2X Cap		2003 Telone Use	Potential Telone Use	Allowed Telone Use 1X Cap	Allowed Telone Use 2X Cap
	ac	*ac*	*ac*	*ac*	*%*	*ac*	*%*	*lbs*	*lbs*	*lbs*	*lbs*
strawberry	4,854	22,301	27,155	15,660	58%	9,724	36%	883,312	4,507,261	1,962,514	2,927,112
sweet potato	4,908	131	5,039	2,227	44%	426	8%	568,135	583,807	316,554	532,697
almond	3,662	2,844	6,506	1,839	28%	1,150	18%	985,379	1,667,932	1,226,551	1,391,942
nursery - outdoor	1,048	2,671	3,720	812	22%	351	9%	277,206	1,158,790	890,743	1,042,826
carrot	11,883	1	11,884	801	7%	272	2%	1,197,998	1,198,098	1,117,979	1,170,947
bushberry	181	1,113	1,294	742	57%	510	39%	21,941	389,291	144,335	220,872
pepper	1,859	1,696	3,555	577	16%	126	4%	162,334	306,517	257,459	295,828
nursery - strawberry	11	2,314	2,325	566	24%	120	5%	3,470	766,985	580,100	727,391
tomato	988	1,740	2,728	554	20%	211	8%	95,650	269,652	214,282	248,514
citrus	954	545	1,500	512	34%	302	20%	216,761	325,826	223,337	265,327
leafy vegetables	1,837	645	2,482	409	16%	217	9%	184,043	232,386	201,716	216,111
melons	2,830	1,543	4,374	301	7%	6	0%	184,510	292,550	271,468	292,108
cut flowers	56	671	727	212	29%	122	17%	11,536	232,888	163,081	192,712
vegetable - misc	1,314	402	1,715	205	12%	84	5%	113,915	148,064	130,605	140,956
potato	2,014	8	2,021	184	9%	0	0%	188,687	189,456	171,083	189,456
perennial - misc	234	467	701	143	20%	4	1%	71,645	225,631	178,423	224,325
Tree fruit - prunus	2,842	335	3,177	137	4%	0	0%	748,345	858,952	813,607	858,809
grape	2,552	353	2,906	114	4%	3	0%	748,494	865,110	827,435	864,049
ornamental	0	322	322	107	33%	63	20%	11	106,107	70,662	85,262
cole crops	702	22	724	88	12%	44	6%	65,723	67,567	60,089	63,797
nursery - greenhouse	28	177	205	57	28%	19	9%	4,998	63,377	44,511	57,110
Other	1,205	428	1,633	37	2%	0	0%	273,906	405,326	396,272	405,243
Total	**45,964**	**40,729**	**86,692**	**26,286**	**30%**	**13,756**	**16%**	**7,007,998**	**14,861,573**	**10,262,806**	**12,413,395**

Table 3. Counties Potentially Impacted by Telone Township Caps (2003 data)

County	2003 Use Telone	2003 Use MeBr	Total	Area that cannot use Telone 1X Cap		Area that cannot use Telone 2X Cap		2003 Telone Use	Potential Telone Use	Allowed Telone Use 1X Cap	Allowed Telone Use 2X Cap	Townships that Exceed Cap 1X	Townships that Exceed Cap 2X
	ac	*ac*	*ac*	*ac*	*%*	*ac*	*%*	*lbs*	*lbs*	*lbs*	*lbs*		
Ventura	1,348	9,166	10,515	6,960	66%	4,750	45%	187,792	1,753,793	581,877	952,446	6	4
Monterey	4,246	7,705	11,950	5,357	45%	3,018	25%	599,024	1,883,719	1,010,228	1,397,912	8	4
Kern	7,210	3,853	11,063	3,674	33%	2,004	18%	924,850	1,893,293	1,128,232	1,436,523	6	2
Santa Barbara	2,066	2,885	4,951	2,884	58%	1,975	40%	354,920	845,248	376,434	524,294	2	2
Merced	6,154	1,207	7,361	2,854	39%	487	7%	753,796	1,089,193	667,310	1,023,531	4	2
Santa Cruz	916	3,103	4,020	2,362	59%	1,373	34%	117,808	718,952	265,842	443,337	4	3
Orange	62	1,985	2,047	487	24%	0	0%	14,240	311,208	235,972	311,208	2	0
Siskiyou	0	1,304	1,304	458	35%	120	9%	0	424,047	272,913	384,453	2	1
San Diego	271	2,005	2,276	343	15%	0	0%	39,791	317,141	275,227	317,141	2	0
Riverside	651	2,008	2,659	323	12%	0	0%	83,406	309,665	281,458	309,665	2	0
Fresno	4,793	752	5,546	166	3%	0	0%	859,857	1,047,846	1,008,290	1,047,846	2	0
Shasta	0	462	462	130	28%	0	0%	0	136,644	97,952	136,644	1	0
Del Norte	440	55	495	79	16%	0	0%	121,198	139,249	113,298	139,249	1	0
San Luis Obispo	747	201	948	59	6%	29	3%	121,134	159,816	153,229	157,387	2	1
Imperial	7,414	730	8,144	45	1%	0	0%	710,854	762,576	758,114	762,576	2	0
Stanislaus	3,009	661	3,670	43	1%	0	0%	628,077	819,874	808,196	819,874	1	0
Tulare	1,393	590	1,982	41	2%	0	0%	322,211	499,039	485,376	499,039	1	0
Madera	1,121	139	1,260	22	2%	0	0%	336,957	376,346	368,935	376,346	1	0
Other	4,121	1,918	6,039	0	0%	0	0%	832,083	1,373,924	1,373,924	1,373,924	0	0
Total for State	**45,964**	**40,729**	**86,693**	**26,286**	**30%**	**13,756**	**16%**	**7,007,998**	**14,861,573**	**10,262,806**	**12,413,395**	**45**	**17**

Table 4. Township list of cumulative Telone use since 1995, remaining years with 2X township cap allowance (for Years Left < 6), 2003 adjusted Telone use and use relative to the township cap (for Cap Ratio > 1); potential Telone use and potential use relative to township cap (for Cap Ratio > 1), and primary fumigated crops.

Township	County	Telone Used 1995 - 2003	2X Cap Left	Telone Used 2003		Potential Telone Use		Primary Crops
		Adj LBS	*Years*	*Adj LBS*	*Cap ratio*	*lbs*	*Cap Ratio*	
M07S11E	Merced	868,441	-0.6	172,819	1.9	236,937	2.6	SWEET POTATO
M15S04E	Monterey	727,034	0.9	174,324	1.9	287,979	3.2	BROCCOLI, SPINACH
M31S29E	Kern	698,762	1.3	107,469	1.2	138,878	1.5	CARROTS, POTATO
M07S12E	Merced	621,540	2.1	165,449	1.8	178,885	2.0	SWEET POTATO
M06S11E	Merced	510,613	3.3	124,249	1.4	173,534	1.9	SWEET POTATO
H18N01W	Del Norte	456,141	3.9	111,973	1.2	112,270	1.2	NURSERY - LILY BULBS
S11N20W	Kern	411,364	4.4	109,943	1.2	121,539	1.3	CARROTS, PEPPERS
S16S15E	Imperial	407,031	4.5	94,537	1.0	94,537	1.0	CARROTS
M06S12E	Merced	401,948	4.5	119,520	1.3	183,391	2.0	SWEET POTATO
M04S07E	Stanislaus	369,596	4.9	82,403				TOMATOES, ALMOND
S10N34W	Santa Barbara, SLO	360,089	5.0	166,491	1.8	446,116	4.9	STRAWBERRY
M18S06E	Monterey	344,407	5.2	63,191		126,255	1.4	GRAPES, WINE
M15S22E	Fresno	335,931	5.3	105,958	1.2	120,532	1.3	NECTARINE
S11N22W	Kern	335,401	5.3					MELONS
M22S10E	Monterey	322,782	5.4					LETTUCE, HEAD
M11S02W	Santa Cruz	317,407	5.5	54,897		450,294	5.0	BRUSSELS SPROUTS
M12S11E	Fresno	316,341	5.5					CANTALOUPE
M06S08E	Stanislaus	306,698	5.6					TOMATOES
M27S25E	Kern	293,197	5.8	89,983		310,872	3.4	CARROTS
M17S06E	Monterey	290,690	5.8					GRAPES, WINE
M32S28E	Kern	289,818	5.8	105,324	1.2	105,324	1.2	CARROTS, POTATO
S11N19W	Kern	286,517	5.8					CARROTS
M12S05E	San Benito	283,124	5.9					ONION, PEPPERS
M16S23E	Tulare, Fresno	281,827	5.9	97,632	1.1	100,767	1.1	PEACH
M15S23E	Fresno	272,503	6.0					PEACH
M14S03E	Monterey	269,239	6.0	147,924	1.6	338,948	3.8	STRAWBERRY
S12S11E	Imperial	267,888	6.0					MELONS
S01N21W	Ventura	263,479		65,602		504,499	5.6	STRAWBERRY, PEPPERS
M12S02E	Monterey, Sta. Cruz	256,207		42,839		522,329	5.8	BRUS. SPROUTS, SBERRY
M05S07E	Stanislaus	230,075		99,789	1.1	102,839	1.1	PARSLEY
M13S02E	Monterey	228,841		38,553		251,985	2.8	BRUSSELS SPROUTS
S14S13E	Imperial	216,357		84,420		90,272	1.0	CARROTS
M26S25E	Kern					505,122	5.6	ALMOND
S02N22W	Ventura					492,071	5.5	STRAWBERRY
S02N21W	Ventura					397,586	4.4	STRAWBERRY
S01N22W	Ventura					311,205	3.4	STRAWBERRY
S10N33W	Santa Barbara					307,722	3.4	STRAWBERRY
M46N01W	Siskiyou					220,094	2.4	STRAWBERRY NURSERY
M12S01E	Santa Cruz					215,792	2.4	STRAWBERRY
M12S03E	Sta Cruz, Monterey					176,409	2.0	STRAWBERRY
M31S30E	Kern					146,275	1.6	CHERRY
S05S08W	Orange					146,090	1.6	STRAWBERRY
S02N23W	Ventura					144,334	1.6	STRAWBERRY
S10S04W	San Diego					138,952	1.5	STRAWBERRY
M13S03E	Monterey					136,039	1.5	STRAWBERRY
S02N20W	Ventura					135,349	1.5	STRAWBERRY, PEPPERS
S08S08E	Riverside					130,975	1.5	MELONS
M37N05E	Shasta					129,824	1.4	STRAWBERRY NURSERY
S06S08W	Orange					126,247	1.4	STRAWBERRY
M46N02W	Siskiyou					111,540	1.2	STRAWBERRY NURSERY
S11S05W	San Diego					110,533	1.2	TOMATO
S07S09E	Riverside					100,707	1.1	PEPPERS
M10S17E	Madera					97,412	1.1	GRAPES
S11N34W	San Luis Obispo					94,537	1.0	STRAWBERRY
M14S02E	Monterey					93,106	1.0	STRAWBERRY

Township Cap Impact on Strawberries

Application method affects potential Telone use. Tables 2 - 4 assume that all strawberry fumigation is by drip application (application factor = 1.16). In 2003, 4854 acres of strawberries were fumigated with Telone products. Of this area, 85% used drip-applied InLine at an average rate of 190 lb/ac of 1,3-D.

Table 5 shows several scenarios for strawberry fumigation varying from shallow shank broadcast fumigation (330 lb/ac with an application factor of 1.9), to drip-applied fumigation to beds (162 lb/gross ac; AF = 1.16), and reduced rate drip bed fumigation. These analyses assume all other fumigated crops in the townships compete equally for Telone, except for alternative 5 that assumes only use on strawberry (no other Telone use in the townships). Note that if *only* strawberry uses Telone, the impact is still large. The 4th alternative assumes strawberry uses InLine at 60% of the recommended rate. This may be achievable by combinations of fumigants (such as higher chloropicrin ratios), improved application efficacy (such as with virtually impermeable films), or by other reduced use practices. Because strawberry production is so concentrated in a few townships (50% of the strawberries are grown in 7 townships) rate reductions give relatively less benefit than for other crops that are more widely dispersed.

Table 5. Township Cap Limitations on Telone Use in California Strawberries. (Based on 2003 CDPR Pesticide Use Report data and on application rates and factors in Table 1.)

	Alternative Application	**Area that Cannot use Telone**				
	Method/Scenario	**1X Cap**			**2X Cap**	
		acres	*%*		*acres*	*%*
1	Drip (beds)	15,660	58%		9,724	36%
2	Shallow Shank broadcast	21,480	79%		17,626	65%
3	Shallow Shank bed	19,844	73%		15,206	56%
4	Drip (beds) (60% rate)	12,946	48%		6,687	25%
5	Drip (beds) (exclusive use)	14,563	54%		8,206	30%
	Assumptions					
	Potential use on 27,155 acres					
	Application rate = 250 lb/ac (38 gal/ac InLine) for drip; and 330 lb/ac (48 gal/ac Telone C-35) for shank; based on treated area.					
	Bed area = 65% of field area					
	Application Factor = 1.9 for shank and 1.16 for drip					
	Exclusive use = no other crops use Telone in the township					

Conclusion

Township caps in California will limit Telone use of some crops - primarily strawberries and crops that are grown in strawberry areas, and other crops with large or concentrated acreage such as sweet potato, tomato, and carrots. I estimate that the overall township cap limitation for all crops will be about 16% of the total acreage at the current 2X cap, and about 30% at the long term 1X cap, depending on which crops use Telone. This analysis, based on 2003 data, does not reflect the effect of future increased acreage or fumigant use. Telone cannot be depended upon to meet all methyl bromide alternative needs in California.