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 that can replace many uses of Methyl Bromide. It has been used successfully for both perennials and annual fruits and vegetables. Its use in California has increased from essentially zero in 1995 when it was reintroduced, to 7,000,000 lbs. in 2002. 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, 35% Chloropicrin) and Telone C-17 (84% 1,3-D, 17% Chloropicrin). New 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 4500 acres of strawberries, melons, and peppers in 2002.

Telone Use Restrictions in California

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

Buffer Zones: The buffer zones for Telone products has been reduced from 300 ft to 100 ft in the *Suggested Permit Conditions* and on the labels for the products. This will significantly reduce the impact of excluded buffer areas. A residence located on the border of a field prohibited application to about 3 acres of the field with 300 ft buffers, but only about 1/3 ac with a 100 ft buffer. A cursory aerial survey of a rural perennial crop area in Fresno county showed an average of 19 residences restricting use on each square mile section (640 ac.) of land. About 10 cropped acres or 2% of the total cropped land fell within the 100 ft. buffer areas and could not be fumigated. The impact will be greater in heavily populated coastal areas, and minimal 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 are 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 HDPE plastic mulch

These township caps result in maximum acreage use per township of:
273 acres (1.1% of land) with deep shank application at 330 lb/ac (perennials),
480 ac. (2.1% of land) with shallow shank application at 94 lb/ac (vegetables)
555 ac. (2.4% of land) with drip applic. at 250 lb/ac in the bed (strawberry)

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 no Telone was used between 1990 and 1994 and use since 1995 has been gradually increasing. In 2002 (and "the next several years"), 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, (or until the regulations are modified).

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, the limitation to converting to Telone use on those fields was projected. Acreage of present methyl bromide and Telone use in each township for each crop was determined. It was assumed that present use of other fumigants (primarily 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 (historic or maximum label) and methods for each crop. 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 presently MeBr and Telone fumigated crops 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 shows the impact of the township caps for the fumigated crops in California based on the 2000 PUR data. Fumigant data from 2001 was not used because total fumigation declined in 2001 due to reduced perennial plantings and the MeBr phaseout. The table shows acreage that could potentially use Telone but 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 potential and allowed Telone use. One-third of the total potential fumigated area (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 18%.

Table 1. Township Cap Limitations on Telone Use in California. (Based on 2000 CDPR Pesticide Use Report data. Assumes all crops that presently use MeBr or Telone will convert to Telone.

Commodity	Potential Telone Use	Area that could not use Telone				Potential Telone Demand	Allowed Telone Use	
		1X Cap		2X Cap			1X Cap	2X Cap
	acres	*acres*	*%*	*acres*	*%*	*lbs*	*lbs*	*lbs*
strawberry	22,373	14,891	67%	10,460	47%	4,215,906	1,409,880	2,244,860
sweet potato	6,076	2,159	36%	954	16%	850,598	548,322	717,059
melons	7,465	1,451	19%	498	7%	522,575	420,972	487,739
nursery - outdoor	5,411	1,277	24%	305	6%	1,785,702	1,364,132	1,684,977
pepper	3,271	861	26%	552	17%	277,998	204,790	231,053
cut flowers	1,426	628	44%	447	31%	470,684	263,386	323,242
grape	5,750	588	10%	28	0%	1,897,450	1,703,377	1,888,244
leafy vegetables	2,206	585	27%	217	10%	165,482	121,579	149,204
bushberry	817	489	60%	359	44%	269,729	108,272	151,165
cole crops	1,417	410	29%	303	21%	120,479	85,608	94,733
tomato	4,127	365	9%	36	1%	350,802	319,795	347,714
almond	2,390	333	14%	52	2%	573,664	493,625	561,304
carrot	7,768	292	4%	64	1%	730,185	702,706	724,182
potato	1,462	161	11%	0	0%	204,677	182,195	204,677
vegetable - misc	993	159	16%	103	10%	84,415	70,938	75,692
Tree fruit - prunus	3,261	147	5%	24	1%	1,076,008	1,027,386	1,067,934
nut tree misc	1,242	99	8%	22	2%	409,804	377,012	402,592
field crops	951	91	10%	11	1%	80,857	73,149	79,883
ornamental	469	90	19%	61	13%	154,769	125,146	134,660
citrus	667	68	10%	31	5%	220,273	197,940	210,161
perennial - misc	504	60	12%	23	5%	166,301	146,458	158,702
misc agri	422	39	9%	19	4%	139,340	126,390	133,174
nursery - greenhse	125	17	14%	12	10%	41,269	35,577	37,344
Total	**80,595**	**25,263**	**31%**	**14,580**	**18%**	**14,808,968**	**10,108,637**	**12,110,296**

The potential uses, and thus 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). Because of strawberries, several other crops grown in the same areas are also impacted (cut flowers, cole crops, leafy vegetables, peppers). The second most impacted crop is sweet potato, because most of the fumigated acreage is concentrated in 6 townships in Merced County. Telone use in processing tomato is increasing, and will 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, or in areas with strawberries. I was unable to differentiate from the PUR database the relative impact on nurseries growing landscape plantings vs. those producing propagation materials for agronomic crops. Perennial crops have only a moderate amount of impact with the 1X cap (about 10% of acreage) and very 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 in these proceedings - *Fumigant Use in California* (Trout) summarizes use of all fumigants by crop in California over the last 5 years.

Table 2 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 drawing 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.

Table 2. Counties Potentially Impacted by Telone Township Caps (2000 data)

County	Potential Telone Use	Area that could not use Telone				Potential Telone Demand	Allowed Telone Use	
		1X Cap		2X Cap			1X Cap	2X Cap
	acres	*acres*	*%*	*acres*	*%*	*lbs*	*lbs*	*lbs*
Ventura	9,281	6,844	74%	5,365	58%	1,786,289	486,976	767,011
Monterey	11,420	5,891	52%	3,900	34%	1,920,785	854,423	1,210,717
Merced	9,155	3,172	35%	1,324	14%	1,403,161	970,634	1,229,235
Santa Barbara	3,908	2,252	58%	1,693	43%	851,756	419,976	531,397
Santa Cruz	3,680	2,114	57%	1,445	39%	768,778	312,053	454,906
Kern	7,614	1,357	18%	275	4%	1,273,403	971,629	1,204,234
Orange	1,857	789	42%	262	14%	328,850	185,448	281,393
Tulare	2,852	691	24%	84	3%	885,560	671,753	857,951
Fresno	5,787	649	11%	189	3%	1,222,715	1,141,224	1,209,452
Stanislaus	4,408	433	10%	0	0%	809,309	753,786	809,309
San Luis Obispo	1,642	244	15%	43	3%	285,466	244,451	281,795
San Joaquin	3,214	235	7%	0	0%	591,396	516,648	591,396
San Diego	2,032	211	10%	0	0%	266,772	240,658	266,772
Riverside	3,188	193	6%	0	0%	340,236	324,981	340,236
Shasta	466	142	30%	0	0%	153,734	106,852	153,734
Del Norte	360	34	9%	0	0%	118,698	107,582	118,698
Imperial	3,716	7	0%	0	0%	323,490	322,871	323,490
Sutter	833	6	1%	0	0%	273,681	271,805	273,681
Other Counties	5,450	0	0%	0	0%	1,243,081	1,243,081	1,243,081
State Total	**80,863**	**25,263**	**31%**	**14,580**	**18%**	**14,847,161**	**10,146,830**	**12,148,488**

The number of years that townships can use 2X caps depends on the use of Telone since it was reintroduced in 1995. Table 3 shows the townships that have the highest combination of potential Telone demand and past Telone use, and the resulting years remaining with credits to allow 2X use. Two townships have less than 2 years of 2X caps available (primary crops: carrots, potato, melons, and sweet potato). Six additional townships have less than 5 years. Most townships will have at least 5 years available at the 2X cap levels.

Table 3. Years of 2X Caps remaining in townships with high Telone use between 1996 and 2001.

County	Township	Potential Telone Use	Telone Use 1996-2001	Yrs. Remaining at 2X Cap
		adj lbs.	*lbs*	*yrs*
Kern	M31S29E	178,539	418,262	1.4
Merced	M07S11E	332,854	382,062	1.8
Monterey	M15S04E	264,451	272,120	3.0
Tulare	M19S25E	208,109	249,553	3.2
Fresno/Merced	M12S11E	246,688	223,412	3.5
Kern	M27S25E	250,740	155,138	4.3
Monterey/Santa Cruz	M12S02E	830,602	131,945	4.5
Ventura	S01N21W	664,566	100,430	4.9
Stanislaus	M04S07E	155,552	217,263	5.0

Township Cap Impact on Strawberries

Application method affects potential Telone use. Tables 1 through 3 assume that all strawberry fumigation is by shank application (application factor = 1.9), and 50% of the shank fumigation is to beds (with an effective application rate of 225 x .675). With the recent registration of InLine, much of the strawberry fumigation has actually been by drip fumigation to beds. Drip application has an application factor of 1.16 (versus 1.9 for shallow shank application). In 2002, about 3060 ac. of strawberries were fumigated with Telone. Of this area, 84% used drip-applied InLine at an average rate of 185 lb/ac and the remaining appeared to use shank bed fumigation (based on application rates).

Table 4 shows several scenarios for strawberry fumigation varying from shallow shank broadcast fumigation (225 lb/ac with an application factor of 1.9), to drip-applied fumigation to beds (152 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 Telone at 60% of the recommended rate. This may be achievable by combination fumigants (ie: higher chloropicrin mixtures), improved application efficacy, or by other reduced use practices.

Because strawberry production is so concentrated in a few townships (60% of the strawberries are grown in 10 townships) other crops will have little impact on strawberry Telone use, although strawberry use has a large impact on other crops grown in the townships.

Table 4. Township Cap Limitations on Telone Use in California Strawberries. (Based on 2000 CDPR Pesticide Use Report data. Assumes all crops that presently use MeBr or Telone will convert to Telone.

	Alternative Application	Area that Cannot use Telone					
	Method/Scenario	1X Cap			2X Cap		
		acres	*%*	*Townships*	*acres*	*%*	*Townships*
1	Shallow Shank broadcast	15,627	70%	27	11,614	52%	23
2	Shallow Shank bed	13,882	62%	24	8,999	40%	19
3	Drip (beds)	11,193	50%	20	5,924	26%	13
4	Drip (beds) (60% rate)	8,410	38%	16	3,304	15%	9
5	Drip (beds) (exclusive use)	9,208	41%	15	4,505	20%	6
	Assumptions						
	Potential use on 27,000 acres						
	Application rate = 225 lb/ac (33 gal/ac Telone C-35; 34 gal/ac InLine)						
	Bed area = 67.5% of field area (avg. of 75% in south and 60% in central coast)						
	Application Factor = 1.9 for shank and 1.16 for drip						
	Exclusive use = no other crops use Telone in the township						

Actual Telone Use in 2002

Telone use in California in 2002 was determined from the CDMS database that tracks 1,3-D use for the purpose of establishing when caps are reached (2002 PUR data is not yet available). Use increased to 6.9 million lbs. in 2002, about 40% higher than in 2001. Primary crops that were planted following fumigation with Telone products included fruit and nut trees, grape vines, carrots, sweet potatoes, and melons. Telone use in 2002 by crop is listed in Table 5.

Over 80% of the product use was Telone II. Many vegetable crops used Telone:chloropicrin mixtures. The two drip-applied Telone products, InLine and Telone were used on 4500 ac in 2002. Over 2500 ac. of strawberry, nearly 10% of the crop, was drip fumigated with InLine. About one-third of the Telone use on melons and one-quarter of the use on peppers were also drip-applied.

All townships were allowed 2X use in 2002. Several of these crops likely used very little MeBr in 2002, so this data provides an indication of which crops (other than strawberry and nursery/ornamentals) would be impacted by the 90,250 (1X) cap. Table 6 summarizes 2002 use for those townships that exceeded 75% of the 1X cap. Nineteen townships exceeded the long term 1X cap in 2002. One township, M07S11E in Merced county exceeded the 2X cap, as was permitted by DPR in a special allowance. Table 5 shows which commodities would have been impacted the most had the 1X cap been enforced in 2002. Without the special allowance, sweet potato would have been heavily impacted with 40% of the crop exceeding the 1X cap. Tree fruit and carrots also exceeded the 1X cap on over 10% of their fumigated acres. Even though Telone was used on only about 10% of the strawberry planted acres, nearly 10% of that area would have exceeded the 1X cap. The caps will seriously constrain the use of Telone products for strawberry fumigation.

Table 5. Telone Use by Commodity, 2002 From CDMS Database (provided by Dow AgroSciences)

Crop	Area Treated	1,3-D Applied	Rate	Area Exceeding Tnshp Cap*	
	(acres)	*(lbs AI)*	*(lbs/ac)*	*(acres)*	*(%)*
PEACHES, PLUMS, NECT.	2,417	739,181	306	299	12%
ALMONDS	1,655	505,115	305	116	7%
GRAPES (WINE)	1,160	375,650	324	2	0%
GRAPES (OTHER)	821	260,528	317	32	4%
WALNUTS	861	264,723	307	0	0%
CHERRY, APPLE	142	46,562	329	0	0%
CITRUS	69	20,730	301	0	0%
RASPBERRIES	172	27,458	159	0	0%
PERENNIALS (misc)	2,180	721,500	331	373	17%
TOTAL PERENNIALS	**9,477**	**2,961,447**			
CARROTS	10,515	1,116,865	106	1,160	11%
SWEET POTATOES	5,621	714,060	127	2,312	41%
STRAWBERRIES	3,065	544,047	177	303	10%
MELONS	4,561	270,675	59	200	4%
TOMATOES	1,693	175,461	104	0	0%
POTATOES	1,997	175,220	88	205	10%
PEPPERS	2,013	169,437	84	38	2%
LEAFY VEGETABLES	1,461	139,107	95	0	0%
COLE CROPS	1,572	127,376	81	0	0%
ONIONS (DRY)	752	61,182	81	89	12%
VEGETABLES (misc)	370	33,812	91	0	0%
TOTAL ANNUAL FRUITS & VEG	**33,620**	**3,527,241**			
NURSERY STOCK	745	225,832	303	13	2%
NURSERIES (other)	75	24,088	323	0	0%
LILY	435	126,561	291	79	18%
FLOWERS (other)	146	26,251	180	0	0%
MISC CROP	321	45,231	141	0	
MISC NON-CROP	42	9,735	233	0	
TOTAL TELONE USE	**44,860**	**6,946,386**			

** Area Fumigated in excess of the 90,250 lb/township cap limit. Up to 180,500 lb/township was allowed in 2002.*

Conclusions

Township caps in California will impact 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 on the 20 to 30 townships where strawberries are concentrated will be over 25% of the total acreage at the current 2X cap, and about 50% at the long term 1X cap, depending on which crops use Telone. Telone cannot be depended upon to meet all methyl bromide alternative needs.

Table 6. Telone Use by Township, 2002 From CDMS Database (provided by Dow AgroSciences)

Township	County	Actual Amount Appl. lbs 1,3-D	Adjusted Pounds	Total Acres	Primary Fumigated Crops
M07S11E*	Merced	244,684	244,684	2,028	Sweet Potato
2X Cap			**180,500**		
M07S12E	Merced	173,471	175,243	1,265	Sweet Potato
M16S19E	Fresno	86,284	163,939	260	Perennials
M31S29E	Kern	151,243	160,538	1,499	Carrots, Potato, Watermelons, Onions
M16S23E	Tulare,	145,838	158,170	456	Fruit Trees
S10N34W	Santa Barbara	132,896	154,160	731	Strawberries
M06S11E	Merced	145,575	152,619	1,017	Sweet Potato
M27S25E	Kern	108,190	148,705	944	Carrots
S16S15E	Imperial	77,865	147,943	861	Carrots
M15S23E	Fresno	112,714	146,648	340	Fruit Trees
M14S18E	Fresno	91,464	140,868	367	Fruit Trees
M14S23E	Fresno	82,066	134,435	305	Fruit Trees
M06S12E	Merced	115,590	121,656	734	Sweet Potato, Almonds
M29S25E	Kern	77,785	116,355	507	Carrots, Almonds
H18N01W	Del Norte	113,623	113,623	383	Flowers
S11N20W	Kern	96,634	107,052	988	Carrots, Peppers
M04S11E	Stanislaus	63,026	97,240	192	Nursery Stock, Nut Trees
M25S26E	Kern	70,497	94,779	243	Grapes
M16S22E	Fresno	79,537	94,170	241	Perennials
Cap			**90,250**		
M03S08E	Stanislaus	82,268	90,120	271	Almonds, Walnuts, Nursery
M14S03E	Monterey	68,208	87,155	340	Strawberries
S01N21W	Ventura	66,081	85,653	616	Peppers, Strawberries
M32S29E	Kern	65,363	82,718	426	Peaches, Potato, Carrots
M17S23E	Tulare	71,673	80,500	245	Perennials
M04S10E	Stanislaus	74,163	78,971	236	Almonds, Walnuts
M03N06E	San Joaquin	42,091	74,389	127	Grapes
M12S11E	Fresno	40,591	74,093	916	Melons
M12S12E	Fresno	39,584	72,414	797	Melons, Tomato
M14S21E	Fresno	61,528	71,295	185	Peaches,Plums
M15S22E	Fresno	58,759	69,631	178	Peaches,Plums
M20S25E	Tulare	36,505	69,359	110	Grapes
75% of Cap			**67,687**		

Adjusted Pounds are the actual pounds of 1,3-D times the application factor for the application method (1.0 - 2.3)

** Township M07S11E was given special allowance by CDPR to exceed cap by 16,500 Adj. Pounds for 2001/02*