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Subject: Soil Fumigants: Use on List 2 Crops

The following information is provided to you from the Western Integrated Pest Management Center in response to your March 12, 2007 inquiry regarding the use of soil fumigants on artichoke, broccoli, Brussels sprouts, cauliflower, celery, field corn, green beans, lettuce, pome fruit, spinach, sugarbeet, sweet corn, and wheat. Although not included on either List 1 or List 2 of the initial soil fumigant request memo, I have also included information on soil fumigation practices for blueberry, mint, raspberry, and vegetable seed crops. My response provides the information I was able to gather for the Pacific Northwest (PNW) Workgroup states of Alaska, Idaho, Oregon, Montana, Utah, and Washington.

Soil fumigants are not used in the production of broccoli, cauliflower, sweet corn, or wheat in our region.

Blueberry – In Oregon 25 to 50% of new blueberry acreage is fumigated, while the estimate for Washington is 50%. Either dichloropropene or a combination of dichloropropene and chloropicrin are used to control root lesion and stubby root nematodes. Fumigant is applied to the entire field where it is shanked in and then the soil is compacted to seal in the fumigant. Fumigation occurs in both the spring and the fall because blueberries are planted in both the spring and fall.

Lettuce – One of the lettuce growers I spoke to in Alaska did report using soil fumigation for weed control. Of their 32 acres of lettuce grown each year, approximately 50% is fumigated prior to planting. They apply metam-sodium (Vapam) through chemigation using an initial rate of 1.5 gallons per acre then reapply at a rate of 1 or 2 quarts per acre two days later. An additional application at the 1 to 2 quarts per acre rate may be made. Metam-sodium applications start the third week of May and continue into June to support their staggered

planting schedule. This grower is using bedded plantings and typically will only fumigate three acres a day. Water is used to seal the soil following the fumigation. Because the primary weed of concern is pineappleweed which is in the same family as lettuce, there is no herbicide available that will control pineappleweed but won't damage the lettuce. Their only other alternative for weed control is hand weeding.

Mint – There is small but very important percentage of PNW mint that is treated with soil fumigants. In order to produce sustainable yields of high quality mint, growers must purchase plant material that is certified disease and nematode free. Since the commercial mint plant is a sterile clone which is vegetatively propagated, a grower wishing to plant a field of mint must obtain planting material (roots/stolons) from a root stock nursery which was initially established from certified mint plantlets. When plants in the root stock nursery have matured, the roots are dug and then used to plant (expand) to larger acreage. The ratio of planting material from a root stock nursery is generally 10:1 which mean a 10 acre root stock nursery can produce enough roots/stolons to plant a 100 acre field of mint. To prevent the spread and/or introduction of diseases, insects and weeds, especially verticillium wilt, root stock nurseries must be clean and pest free prior to establishment. All mint growers in the PNW fumigate their root stock nurseries with either Vapam or Telone prior to planting certified mint plantlets. It is estimated that, overall, 10% of the PNW mint acreage is fumigated. The majority of the mint is planted in the spring but in some areas mint is planted in the fall. Approximately 75% of mint fumigation occurs in the spring but the remaining 25% is treated in the fall. Soil fumigation is necessary to control verticillium wilt (*Veticillium dahliae*) and nematodes with the majority of growers contracting with commercial applicators for fumigation services. There is still some field fumigation in mint but present day large scale fumigation is rare due to economics. In the past when mint oil prices were higher, in areas with high levels of verticillium wilt such as Oregon's Willamette Valley, 60% of the mint acreage would be fumigated. When prices for mint oil decreased due to global markets/foreign competition these areas were taken out of mint production. Should the price of mint oil increase, the mint acreage needing fumigation would likely also increase.

Red Raspberry – Each year in Washington and Oregon between five and ten percent of the raspberry acreage is replanted. In Washington 100% of this acreage is fumigated prior to planting, while in Oregon between 20 and 25% of this acreage is fumigated. (There is no fumigation in Oregon's black raspberry production.) Growers fumigate with either dichloropropene or a combination of dichloropropene and chloropicrin, depending upon the history of the field. The dichloropropene is used for the control of nematodes (root lesion and dagger) and the chloropicrin is used to control phytophthora. Fumigation is primarily done in the fall because, in the raspberry growing areas, springs are often too cold and/or wet and fumigation often can't be done early enough to support spring planting. Here the entire field is treated. The product is shanked in then the soil is compacted to seal in the fumigant. The alternatives for growers are to use fenamiphos (Nemacur) but this will only control root lesion nematodes and provides no control for dagger nematodes or phytophthora. Soils used to produce raspberry nursery stock are also fumigated with a combination of dichloropropene and chloropicrin. In this case the ground is sealed with a tarp following the fumigation.

Sugarbeet – There are two companies in the PNW that contract for sugarbeet production: The Amalgamated Sugar Company and Western Sugar. The Amalgamated Sugar Company fumigates approximately 40% of its 190,000 sugarbeet acres in Idaho, Oregon, and Washington. They are using either metam-sodium (Vapam HL) or a combination of chloropicrin and dichloropropene (Telone C-17). Soil fumigation is used to control sugarbeet cyst nematode, various root diseases, and weed seeds. Growers use Telone for sugarbeet cyst control and Vapam for the control of disease and weeds. The bulk of the sugarbeet acreage that is fumigated is fumigated with Telone with only one or two percent of the acreage treated with Vapam. Vapam HL is applied at 37.5 to 75 gallons per acre and Telone C-17 is applied at 21.6 gallons per acre. (Growers in the PNW have found that if sugarbeets are planted following either potatoes or onions, a single fumigation will be effective for two crop seasons.)

Fumigation occurs in the fall in late September or early October. The product is either shanked in or is applied with a moldboard plow where the fumigant is applied as the plow inverts the soil. The fumigant is sealed in when the fields are rolled and smoothed using a ground hog with harrow. Between 30 and 60 acres per day can be fumigated depending upon the size of the operation and the type of equipment being used. The field preparation is either flat or bedded depending upon the area and current cultural practices. Certain varieties of oil radish have been shown to control sugarbeet cyst nematode; however, this treatment has not been widely adopted for two reasons. First, oil radish is planted in August and growers in the region are often short of water at this time. Second, the crop must be planted at a time when other crops are being harvested. Farm equipment is tied up with these other crops making planting a new crop difficult.

Western Sugar reports fumigating approximately 2,500 of its 25,000 to 30,000 acres of sugarbeets each year. They are using dichloropropene (Telone II). Because this ingredient was not on the list of fumigants under review, no additional information is included here.

Tree Fruit – Debbie Carter of the Northwest Horticultural Council contacted EPA's Bill Chism for clarification about the request for information relating to tree fruit soil fumigant use. She was told that EPA has expanded the orchard replant use, shown on List 1 of the request memo, to include PNW stone fruit and pome fruit. I understand that Ms. Carter has offered to provide additional information on the use of soil fumigants in PNW tree fruit production, should there be further questions, thus, I am providing no tree fruit information in this response.

Vegetable Seed – Soil fumigation is used in vegetable seed production in the PNW. In spinach seed, soil fumigation is used in beds used in breeding programs, in foundation seed production, and in the production of stock seed. Note that this use is not in fields used for spinach seed production but in fields used to produce the seed which is then planted to produce the spinach seed crop. Washington State is an important producer of spinach seed, growing approximately 75% of the US spinach seed and between 8 and 10% of the world's spinach seed. Thus the stock seed used to produce this seed crop is an important commodity. Alf Christiansen contracts for their soil fumigation. The fumigation is done using a combination of chloropicrin and methyl bromide (existing stocks). While fumigation controls weeds, the main reason soil is fumigated is to control fusarium. Fusarium can destroy an entire spinach crop and because of the importance of the breeding program and the stock seed production, 100% of this acreage (a total of 15 to 17

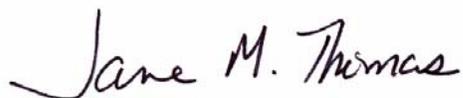
acres each year) is fumigated. Typically fumigation occurs in the fall during the first part of September. If rain or decreasing soil temperatures precludes soil treatment, fumigation is sometimes completed in March. The fumigant is shanked into the soil 12 to 14 inches and the ground is sealed with a tarp. Alf Christiansen has been looking but hasn't yet found a satisfactory alternative for fusarium control. Dichloropropene will control nematodes but won't control disease. Both metam-sodium and chloropicrin alone have been tried but haven't been found to be effective for fusarium control. Likely Alf Christiansen will resort to long rotations out of spinach seed. Once a field has become contaminated with fusarium, spinach can't be planted for eight to ten years. Rotation is not the alternative of choice because the rotation intervals are so long and because, with the seed industry's isolation requirements for these types of fields, finding suitable acreage is difficult.

Soil fumigation is also sometimes used in the production of Swiss chard stock seed. In this situation fumigation is used to kill any Swiss chard seed that remains in the field when the production is being switched from one type of Swiss chard to another. Because of the expense associated with fumigation this is not the first choice. Alf Christiansen will attempt to find another field to use that meets their isolation requirements and will use fumigation only if another suitable piece of land can not be found.

In our region up to 50% of onion and carrot seed crops may be grown from transplanted stecklings or bulbs. When the seed crop is grown from transplants, 100% of the acreage is fumigated with either Telone or Vapam. Fumigation is used to control both diseases and weeds. Here the fumigation is typically done in the fall and the stecklings or bulbs are then planted in the spring.

I hope that you find this information useful. I am attaching a contact sheet for your use should you have further questions.

Sincerely,

A handwritten signature in cursive script that reads "Jane M. Thomas".

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Soil Fumigant Use - List 2 Crops

Contact List

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beet, sugar	Steiger	Andrew	Western Sugar	Agriculturalist	(406) 247-8013	apsteiger@westernsugar.com	Montana
beet, sugar	Searle	Dennis	The Amalgamated Sugar Co.	Agronomist	(208) 724-8307	dsearle@amalsugar.com	Multiple
beet, sugar	Jacobsen	Barry	Montana State University	Plant Pathology	(406) 994-5161	UPLBJ@montana.edu	Montana
beet, sugar	Steiger	Andrew	Western Sugar	Agriculturalist	(406) 247-8013	apsteiger@westernsugar.com	Montana
blueberry	Cieslar	Brian	Whatcom Farmers Co-Op	Agronomist	(360) 354-2418	BrianC@wfcoop.com	Washington
blueberry	DeFrancesco	Joe	Oregon State University	Assistant	(541) 737-0718	defrancj@hort.oregonstate.edu	Oregon
corn, sweet	Mohan	Krishna	University of Idaho	Extension Plant Pathologist	(208) 722-6701	kmohan@uidaho.edu	Idaho
corn, sweet	McReynolds	Bob	Oregon State University	Extension Horticulturist	(503) 678-1264	bob.mcreynolds@oregonstate.edu	Oregon
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lettuce	VanderWeele	Ben	Grower	Grower	(907) 745-3597	vdweele@mtaonline.net	Alaska
mint	Lundy	Rocky	Mint Industry Research Council	Executive Director	(509) 427-3601	mirc@gorge.net	Washington
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raspberry	DeFrancesco	Joe	Oregon State University	Assistant	(541) 737-0718	defrancj@hort.oregonstate.edu	Oregon
raspberry	Purcell	Tim	Trident Ag		(360) 630-4285	barbandtimpurcell@msn.com	multiple
tree fruit	Carter	Debbie	Northwest Horticultural Council	Technical Issues Manager	(509) 453-3193	carter@nwhort.org	Washington
vegetable seed	Rosti	Dwayne	Helena Chemical Company	Fieldman	(208) 250-3398	hcc-idaho@netzero.net	Idaho
vegetable seed	Klein	Paul	Seminis Vegetable Seed	Fieldman	(360) 466-3860	paul.klein@seminis.com	Washington
vegetable seed	DuToit	Lindsey	Washington State University	Vegetable Seed Pathologist	(360) 848-6140	dutoit@wsu.edu	Washington
vegetable seed	Martin	Jerry	Alf Christiansen	Fieldman	(360) 661-7740	jerry_martin@alfseed.com	Washington
vegetable seed	Purcell	Tim	Trident Ag		(360) 630-4285	barbandtimpurcell@msn.com	multiple
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