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Subject: Methoxyfenozide: Use and Usage

I am responding to your request for information on the use and usage of methoxyfenozide. This response from the Western Integrated Pest Management Center provides input from a seven-state region: Alaska, California, Idaho, Montana, Oregon, Utah, and Washington.

**Almond:**

See the attached information provided by the Almond Board of California.

**Alfalfa:**

In California, where over a million acres of alfalfa are grown, methoxyfenozide is one of the softer insecticides used to manage a complex of lepidopterous larvae that infest this crop from June to October. These pests include alfalfa caterpillar, beet armyworm, Western yellow-striped armyworm, webworm, and several cutworm species. These pests often build-up with each alfalfa cutting. Organophosphate, carbamate, and pyrethroid insecticides have historically been used for these pests so an insect growth regulator with a narrow spectrum is a welcome addition to IPM programs. Alfalfa fields contain a wealth of natural enemies so conserving these beneficial organisms is always a goal for growers. The 2011 California Pesticide Use data (attached) shows that 97,310 acres of alfalfa were treated with methoxyfenozide. There were a total of 10,083 pounds AI applied or 0.104 lbs. AI per acre. Most of these applications were made aerially.

**Blueberry:**

There is little methoxyfenozide used in blueberries. It is sometimes used as a rescue spray in cases where growers didn't think they had leafrollers, spanworm, or winter moth and failed to apply an insecticide pre-bloom. When used in this way a single ground application is made during bloom at the label rate of 0.16 to 0.25 # AI per acre.

**Lettuce:**

In California lettuce production methoxyfenozide is still an important component in the management of lepidopteran pests, specifically fall armyworm and looper. Over the last few years a few new insecticides have become available for use and while these insecticides are very effective against lepidopteran pests they are expensive. Methoxyfenozide is relatively cheap, provides reasonably good control, and is typically used as a rotational material.

Now with availability of other effective insecticides, methoxyfenozide is used once per season per crop. (There are at least three crops per year in the Salinas Valley.) Applications are foliar and the normal use rate is 8 oz. per acre.

**Pistachio:**

Methoxyfenozide is a critical chemical in the control of lepidopteran pests, particularly navel orange worm (NOW). NOW is the single most significant insect pest of pistachio and requires multiple sprays for adequate control in most areas. Methoxyfenozide is a very effective chemical and, equally important, it is a unique chemistry with low impact on beneficial insects. It is used sometimes as a single application in areas with low pest pressure but is more commonly used in rotation with other insecticides, particularly pyrethroids. As you can see from the attached California use data, in 2011 there were 450 applications totaling 46,950 acres using 16,882 pounds of the insecticide (5.75 oz. per acre). When used, it is applied once per season, generally by ground sprayers. There have been some experiments where multiple applications have been used but this is not a common practice among growers. Applications tend to be early in the season when access to the orchard is relatively simple thus aerial applications are rare.

**Tree Fruit:**

In general methoxyfenozide is used in pome and stone fruit for caterpillar control. It is widely used as a leafroller material and as a soft codling moth material when pressure is low to moderate.

In Utah fruit growers primarily use methoxyfenozide in apple for codling moth control, in tart cherry and apple for leafrollers, and in peach, nectarine, and apricot for the control of peach twig borer. The use in apples for codling moth control is categorized as important. Many apple orchards are treated with at least one application of methoxyfenozide per season. The use rate is typically 16 oz. per acre. It is applied by air blast sprayer and 1 or 2 applications are made per season. Methoxyfenozide use in tart cherry for leafroller control is also important.

Obliquebanded leafroller has become a greater problem in tart cherry with the phase-out of azinphos methyl. In this case methoxyfenozide is typically used once per season at 8 to 16 oz. per acre. It is applied by air blast sprayer and typically 1 application is made per season. In apples for leafroller control methoxyfenozide use is also characterized as important. When methoxyfenozide is used in apples it typically targets both codling moth and leafroller with the same application. Methoxyfenozide is also used in peach and apricot for peach twig borer and here the use is of medium importance. It is a nice option to use an insect growth regulator in rotation with other chemistries, but less than half of the peach orchards are treated with methoxyfenozide each season. When used it is applied at 8 to 16 oz. per acre. It is applied using air blast sprayers and one application is made per season. Although Utah nectarine acreage is

low there is some use of methoxyfenozide for peach twig borer control and this use is also considered of medium importance.

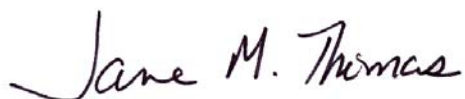
According to the Northwest Horticultural Council in 2011 methoxyfenozide was used in 30% and 20% of Oregon and Washington's pome fruit acreage, respectively. It was used to control codling moth, lesser appleworm, oriental fruit moth, obliquebanded leafroller, pandemic leafroller, European grapevine moth, eyespotted bud moth, fruit tree leafroller, light brown apple moth, redbanded leafroller, variegated leafroller, rufted apple bud moth, spotted tentiform leafminer, western tentiform leafminer, and lacanobia fruitworm. Methoxyfenozide is either applied by air or ground equipment. According to the 2011 data from the National Agricultural Statistics Service (NASS) in Oregon applications averaged 0.249 # per acre per application and the average number of applications per season was 1.3. In Washington pome fruit was treated at 0.242 # per acre per application and an average of 1.3 applications were made per season.

In 2011 20% of Oregon's stone fruit acreage was treated with methoxyfenozide while minimum use was reported in Washington. Methoxyfenozide was used to control codling moth, oriental fruit moth, peach twig borer, oblique banded leafroller, pandemic leafroller, European grapevine moth, fruit tree leafroller, light brown apple moth, omnivorous leafroller, eyespotted bud moth, redbanded leafroller, three lined leafroller, tufted apple bud moth, variegated leafroller, cherry fruitworm, green fruitworm, lesser appleworm, redhumped caterpillar. Methoxyfenozide is either applied by air or ground equipment. According to the 2011 data from NASS in Oregon applications averaged 0.27 # per acre per application with an average of 1.1 applications per season.

I have attached the California methoxyfenozide use information.

I hope you find this information useful.

Sincerely,

A handwritten signature in black ink that reads "Jane M. Thomas". The signature is written in a cursive, flowing style.

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## Methoxyfenozide Use in Almonds

*Methoxyfenozide is an insect growth regulator used to control Navel Orangeworm and Peach Twig Borer. If left untreated, these pests can cause major economic damage and food safety concerns in almond orchards.*

### Navel Orangeworm

One of the most serious insect pests of almonds in California is the navel orangeworm (NOW). It poses a high risk to an almond crop because the worms bore into the nut and consume most of the nutmeat. A second risk is that NOW opens the door to aflatoxin contamination.

- Aflatoxin produced by *Aspergillus* mold is a known carcinogen and mutagen. It is a major concern for the almond industry because of increasingly stringent maximum limits for aflatoxin contamination in key export markets. Navel orangeworm damage in the orchard opens the door for *Aspergillus* molds to reach the nuts and thus aflatoxin production; therefore, the first line of defense in preventing aflatoxin is to manage NOW in the orchard.
- Treatment decisions for NOW are made on the basis of several sampling and monitoring techniques, including a harvest sample, number of mummy nuts per tree after budswell, degree-day accumulation to predict egg hatch, and egg traps to confirm when hatch begins.
- Methoxyfenozide treatment can be made either in spring or at hullsplit (July). Dormant sprays do not control navel orangeworm.

### Peach Twig Borer

Before the arrival of the navel orangeworm (NOW) in the 1940s, the peach twig borer (PTB) caused the most damage to almond nutmeats. Researchers have discovered a relationship between the two insects: nuts attacked by PTB are favored over sound nuts by NOW. Subsequently, the damage from PTB can be masked by NOW feeding.

- Treatment decisions for PTB are made by monitoring hibernacula at the beginning of bloom to determine when larvae are emerging; and placing pheromone traps out around April 1, and monitoring for shoot strikes to catch any in-season problems.
- Preferred treatment timing is during full bloom (February-March) or petal fall (March). Spring spray may be needed if bloom spray has not been successful.

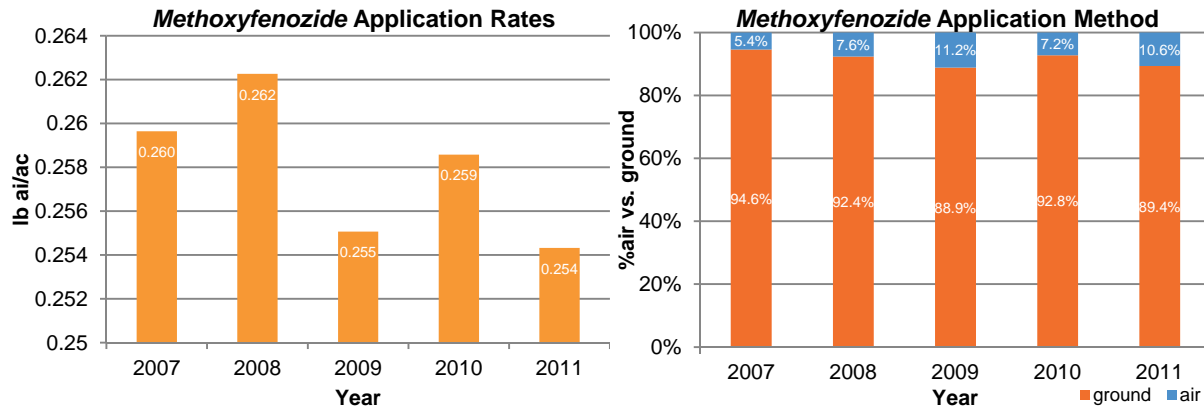
### Suggested Usage

The Almond Board of California suggests using monitoring and treatment decision guidelines from the *UC IPM Pest Management Guidelines: Almond*. If treatment for NOW or PTB is required, UC IPM guidelines suggest Intrepid (methoxyfenozide) as a treatment option by following label rates and methods.

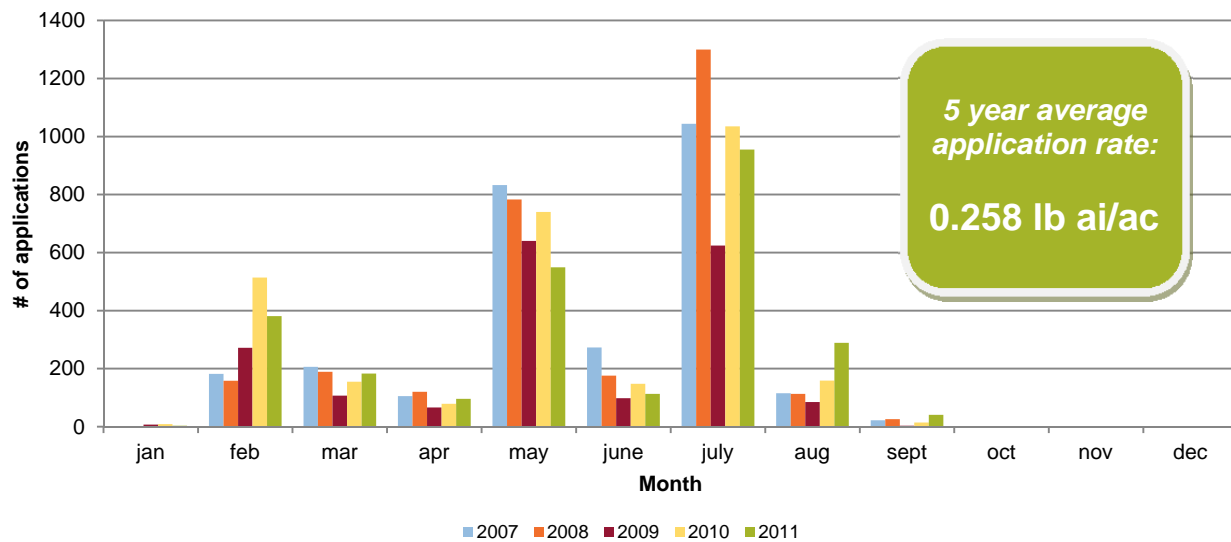
- Navel orangeworm application rate: 0.19-0.38 lb ai./ac (12-24 fl oz/ac)
- Peach twig borer application rate: 0.12-0.25 lb ai./ac (8-16 fl oz/ac)
- Intrepid may be applied through ground or aerial application.

## Observed Usage

The following represents observed usage patterns in California almond orchards between 2007 and 2011.



## Timing of Methoxyfenozide Application



## Importance

As previously described, peach twig borer can cause shallow channels and surface grooves on the nutmeat. These damaged nuts are more appealing to navel orangeworms who will then consume most of the nut and produce large amounts of webbing and frass, opening the door to aflatoxin contamination. For this reason, growers look to insect growth regulators like Intrepid (methoxyfenozide) to control these pests at their larval stage.

- Prior to its ban in 2010, Guthion (azinphos-methyl) was the main compound used to control NOW. It has since been replaced by pyrethroids and insect growth regulators, such as methoxyfenozide, which are essential in controlling NOW populations.

Department of Pesticide Regulation  
2011 Annual Statewide Pesticide Use Report  
Indexed by Chemical

Chemical Commodity	Pounds Applied	Agricultural Applications	Amount Treated	Unit Type
Tomatillo	6.75	2	10.00	A
Tomato	2,623.03	93	4,206.91	A
Tomato, Processing	6,903.26	111	12,227.10	A
Turnip (Forage - Fodder)	0.45	1	0.50	A
Unknown	64.35	2	71.50	A
Walnut	1.80	1	202.00	A
Watermelon	2,781.32	106	3,364.70	A
Wheat	1,348.31	26	3,754.00	A
Wheat (Forage - Fodder)	33.75	1	75.00	A
Chemical Total	219,636.94	14,272		
<b>METHOPRENE</b>				
County Ag Comm	0.12			
Landscape Maintenance	22.02			
Public Health	1,356.36			
Regulatory Pest Control	4.62			
Rights Of Way	4.42			
Structural Pest Control	264.59			
Water Area	12.01		896.00	A
Chemical Total	1,664.15			
<b>S-METHOPRENE</b>				
Almond	420.97	594	61,038.83	A
Commodity Fumigation	0.17			
Grape	0.06	1	8.00	A
Landscape Maintenance	27.88			
Mushroom	13.38	1	6.80	A
	1.32	32	192,000.00	S
Total Pounds On This Commodity	14.69			
Mushroom House	1.58	1	0.08	A
N-Grnhs Flower	< 0.01	1	3.00	A
N-Outdr Plants In Containers	0.01	7	7.15	A
Orange	0.66	10	483.80	A
Pomegranate	2.21	2	294.08	A
Public Health	2,998.04			
Regulatory Pest Control	1.91			
Rights Of Way	52.75			
Structural Pest Control	31.35			
Tangerine	2.00	7	434.69	A
Uncultivated Ag	0.03	1	3.00	A
Walnut	2.68	7	347.50	A
Water Area	0.93		72.94	A
Chemical Total	3,557.92	664		
<b>METHOXYCHLOR</b>				
Carrot	38.13	3	58.00	A
Structural Pest Control	0.53			
Chemical Total	38.66	3		
<b>METHOXYFENOZIDE</b>				
Alfalfa	10,082.50	1,523	97,309.59	A
Almond	45,776.25	2,621	180,065.52	A
Amaranth, Edible (Chinese Spinach)	3.71	3	42.00	A
Apple	195.23	40	840.03	A
Apricot	211.52	24	959.50	A

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Chemical Commodity	Pounds Applied	Agricultural Applications	Amount Treated	Unit Type
Artichoke, Globe	248.51	113	1,664.42	A
Avocado	18.10	3	64.00	A
Bean, Dried	494.86	52	3,395.20	A
Bean, Succulent	200.12	28	1,242.57	A
Beet	56.89	138	320.20	A
Bok Choy	50.34	110	435.63	A
Broccoli	562.18	133	3,583.46	A
Brussels Sprout	23.94	5	109.00	A
Cabbage	190.52	144	1,267.63	A
Cantaloupe	2,149.14	265	15,253.14	A
Cardoon	1.27	4	9.20	A
Carrot	135.50	34	1,289.70	A
Cauliflower	137.52	38	892.15	A
Celeriac	8.04	26	40.66	A
Celery	2,332.07	1,186	15,554.36	A
Cherry	2,021.66	441	9,846.58	A
Chinese Cabbage (Nappa)	76.30	117	495.04	A
Cilantro	8.62	21	42.23	A
Collard	9.32	31	49.58	A
Corn (Forage - Fodder)	843.47	132	5,639.14	A
Corn, Human Consumption	237.84	65	1,805.80	A
Cotton	1,316.11	71	8,758.35	A
Cucumber	0.75	1	7.00	A
Daikon	3.50	16	17.64	A
Dandelion Green	0.75	4	3.83	A
Eggplant	12.22	5	77.10	A
Endive (Escarole)	2.59	21	16.13	A
Fennel	36.91	50	276.75	A
Gai Lon	7.32	9	77.50	A
Grape	13,477.98	1,760	72,609.88	A
Grape, Wine	26,564.22	3,186	126,409.73	A
Grapefruit	5.58	2	24.00	A
Kale	22.83	55	143.78	A
Kohlrabi	2.09	14	11.30	A
Landscape Maintenance	0.60			
Leek	10.92	38	58.38	A
Lemon	7.40	5	53.98	A
Lettuce, Head	2,662.84	1,370	19,214.82	A
Lettuce, Leaf	1,253.62	848	8,825.48	A
Melon	932.99	90	6,533.49	A
Mizuna	0.02	1	3.50	A
Mustard	14.76	45	86.90	A
N-Grnhs Flower	3.15	7	11.25	A
	0.42	1	10,345.00	U
Total Pounds On This Commodity	3.57			
N-Grnhs Plants In Containers		3.03	6	9.80 A
		0.09	1	19,000.00 S
Total Pounds On This Commodity	3.12			
N-Grnhs Transplants		0.02	1	0.10 A
		< 0.01	1	100.00 S
Total Pounds On This Commodity	0.02			
N-Outdr Flower		3.87	10	19.31 A
N-Outdr Plants In Containers		39.32	85	183.83 A
		1.79	6	202,200.00 S
Total Pounds On This Commodity	41.11			
N-Outdr Transplants		81.76	58	1,308.64 A
		19.57	59	9,067,800.00 S

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Chemical Commodity	Pounds Applied	Agricultural Applications	Amount Treated	Unit Type
Total Pounds On This Commodity	101.33			
Nectarine	390.11	137	1,598.60	A
Oat (Forage - Fodder)	4.87	2	69.00	A
Olive	2.05	3	11.00	A
	< 0.01	2	300.00	S
Total Pounds On This Commodity	2.06			
Onion, Dry	4.34	2	22.50	A
Onion, Green	0.16	2	0.96	A
Orange	85.67	21	347.50	A
Parsley	6.24	17	35.39	A
Peach	2,637.49	502	10,970.61	A
Pear	504.22	69	1,907.82	A
Peas	8.30	6	64.70	A
Pepper, Fruiting	452.96	81	2,685.16	A
Pepper, Spice	15.40	7	101.20	A
Pimento	26.36	11	186.60	A
Pistachio	16,882.29	450	46,949.62	A
Plum	452.35	152	1,822.75	A
Pome Fruit	1.69	2	6.00	A
Pomegranate	5,605.63	117	21,301.59	A
Prune	62.98	12	368.20	A
Pumpkin	98.33	18	725.00	A
Quince	7.65	6	27.00	A
Radicchio	0.58	5	4.11	A
Radish	0.32	4	1.78	A
Regulatory Pest Control	90.37			
Research Commodity	0.20			
	0.14	1	1.00	A
Total Pounds On This Commodity	0.34			
Soil Fumigation/Preplant	20.01	2	141.00	A
Sorghum (Forage - Fodder)	26.16	6	229.00	A
Spinach	286.92	212	2,104.69	A
Squash	55.75	18	370.60	A
Squash, Zucchini	4.24	2	30.00	A
Stone Fruit	4.88	1	23.00	A
Strawberry	2,716.91	375	15,256.03	A
Sudangrass	145.61	34	1,115.00	A
Sugarbeet	1,829.03	295	21,791.10	A
Sweet Potato	3.12	1	22.00	A
Swiss Chard	82.14	220	615.61	A
Tangerine	73.40	21	428.70	A
Tomato	1,637.55	210	9,607.98	A
Tomato, Processing	4,854.99	373	28,363.76	A
Turnip	4.84	18	24.44	A
Unknown	13.43	42	68.76	A
Vegetable	< 0.01	1	0.06	A
Walnut	4,541.79	512	17,086.02	A
Watermelon	1,567.38	219	9,965.66	A
Wheat	1.76	2	16.50	A
Wheat (Forage - Fodder)	5.96	1	75.00	A
Chemical Total	157,780.97	19,317		
<b>METHYL ANTHRANILATE</b>				
Blueberry	207.40	9	1,974.00	A
Landscape Maintenance	18.55			
Structural Pest Control	196.81			



Methoxyfenozide  
Contact List

<b>First Name</b>	<b>Last Name</b>	<b>Work Phone</b>	<b>Email</b>	<b>Organization</b>	<b>title</b>	<b>Crop</b>	<b>State</b>
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