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HORTICULTURAL OIL SPRAYS TO CONTROL PESTS OF LANDSCAPE PLANTS: AN INDUSTRY SURVEY

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Abstract. During 1983-84, a 3-page questionnaire was distributed to selected Green Industry companies to document oil-use practices. More than half of the respondents had never used oil for pest control. The majority of those who used oil, found it to be an effective product to control or deter scale insects and mites. From this group of people, 54% found pest control to be improved when a synthetic organic pesticide was added to the oil. Most respondents did not report phytotoxicity problems. However, plants most frequently injured (presumably from the oil applications) were aucuba, cryptomeria, hickory/pecan, Japanese holly and Japanese, sugar, and red maples. The majority of applications (64%) were made in the spring and only 8% (of all applications) were applied in the summer.

Résumé. En 1983-84, un questionnaire de trois pages fut distribué à certaines compagnies de l'Industrie Verte pour documenter l'utilisation de l'huile. Plus de la moitié des répondants n'avaient jamais utilisé de l'huile à des fins de contrôle d'un insecte. La majorité de ceux qui avaient utilisé de l'huile ont trouvé que c'était un produit efficace pour contrôler ou décourager les cochenilles et les acariens. De ce groupe, 54% ont trouvé que le contrôle des insectes était amélioré lorsqu'un pesticide organique snythétique était ajouté à l'huile. La plupart des répondants n'ont pas observé de problèmes de phyto-toxicité. Cependant, les plantes les plus fréquemment blessées (présumément suite à l'application de l'huile) étaient l'aucuba. le cryptomeria, le caryer, le houx japonais, l'érable rouge et l'érable à sucre. La majorité des applications furent faites au printemps et seulement 8% (de toutes les applications) le furent à l'été.

Horticultural oils hold a unique position in the pesticide marketplace. None of the basic refiners advertise these products, and they do little to promote their use. When horticultural oils are promoted, it is done by small agricultural chemical companies that have obtained their own label and trade name. Consequently, compared to the marketing exposure of synthetic pesticides, horticultural oil remains relatively obscure.

During the fall of 1983, after discussions with arborists and nurserymen throughout the United States, plans were developed to selectively survey the Green Industry to evaluate use, knowledge, and perception about horticultural oils as pesticides. At that time it was perceived that the members of the Green Industry, in general, had little concrete knowledge about horticultural oil and its use, and it was apparent that they did not have access to current, unbiased information.

Opinions regarding the use of oil were quite varied. Some arborists and nurserymen used oil routinely and effectively without causing plant injury. Others were skeptical about using oil, even though their bias was often based on one bad experience. The general opinion was that the Industry would benefit by documenting both good and bad experiences. Therefore, we are reporting Green Industry uses, scientifically established or otherwise. We do support and encourage the use of oil, but do not condone all of the uses reported in this summary.

A questionnaire was sent to 3,500 people, representing nurserymen, arborists, landscapers, golf course superintendents, urban foresters, arboretum and botanical garden managers, and park managers. Since many questions did not pertain to pests or practices found or utilized in all geographical areas, respondents did not answer all questions.

Questionnaire Results

Of the 3,500 questionnaires distributed, 35% (1225) were returned; 698 (57%) of the respondents did not or have never used horticultural oil and, of those, 1% did not realize that the product existed. Replies were received from 45 states, the District of Columbia, and five Canadian provinces. By Green Industry divisions, 25%

were arborists, 30% landscapers, 37% nurserymen, and 8% were in other categories. Of the 527 using oil, 284 (54%) routinely apply it as a general purpose spray.

Improved pest control was reported by 54% when another pesticide was added to oil; 40% indicated no experience with combinations. The most commonly added pesticides, (in decreasing order), were ethion, diazinon and malathion. A few respondents were using a relatively new premix containing Trithion. Others acknowledged that they were experimenters and had tried Orthene, Dursban, Cygon, Pentac, Kelthane and Thiodan with the oil. One respondent in Oregon uses 2% oil all season long; not for its pest control attributes, but because he feels that it enhances the effectiveness of the synthetic pesticides in a tank mix.

Respondents used horticultural oil most frequently as a spring season treatment. Regardless of the pest, about 65% of the applications were in the spring, about 16% in the fall and 11% in the winter months (common in Pacific Coast states and Florida). Very few applications (8%) were made as a summer treatment. Selected pests and data on timing of oil applications are presented in Table 1. A few individuals reported a routine practice of spraying oil on woody plants three times per year (spring dormant, summer, and fall dormant).

Oil was used most frequently to control scale insects and mites. The survey contained a section that asked for an evaluation of the efficacy of the oil applications (Table 2). Oil applications for scale control were considered to provide acceptable to complete control (86% of the responses), and applications for mite control were considered as acceptable to complete (89% of the responses).

From replies to the section on the quantity of oil used per year, the senior author conservatively

Table 1. Summary of survey data showing application timing for various arthropod pests.

Pest	*Time of application (% replies)*				
	No. Replies	*Spring Mar-May*	*Summer Jun-Aug*	*Fall Sep-Nov*	*Winter Dec-Feb*
Scales					
Tea	139	45	10	28	17
Juniper	99	74	6	13	7
Oystershell	264	70	6	15	9
Euonymus	276	63	9	15	12
Pine needle	198	75	5	13	8
Magnolia	113	65	10	19	7
Lecanium	89	73	8	11	8
Cottony maple	116	70	6	14	10
Aphids	143	59	13	15	13
Mites					
Spider	205	62	9	16	12
Spruce	84	79	6	10	6
Southern red	56	46	14	23	16
Mealybugs	119	66	12	13	10
Whiteflies	90	46	19	23	12
Others (eggs of)					
Cankerworms	57	81	2	12	5
Webworms	62	63	10	15	13
Leafrollers	46	29	1	6	10
Leaf beetles	29	66	7	17	10

Table 2. Selected pest species and collective opinions about the pesticidal effects of horticultural oil.

Pest	*No. replies*	*% of Replies*			
		Poor-None	*Acceptable*	*Good*	*Complete*
Scales					
Tea	80	14	46	31	9
Juniper	71	6	35	58	1
Oystershell	188	15	42	39	3
Euonymus	180	16	38	41	4
Pine needle	133	15	28	51	6
Magnolia	80	11	28	57	3
Lecanium	64	13	38	47	3
Cottony maple	91	9	40	45	6
Aphids	85	18	35	40	7
Mites					
Spider	133	13	38	43	7
Spruce	59	14	34	49	3
Southern red	29	10	34	52	3
Mealybugs	68	16	37	47	0
Whiteflies	49	27	27	41	6
Others (eggs of)					
Cankerworms	40	38	35	25	3
Webworms	41	29	29	37	5
Leafrollers	29	31	24	45	0
Leaf beetles	16	25	44	31	0

Table 3. Seasons that oil applications are made by Green Industry respondents and subsequent degree of injury to various common plant species.

Plant	*Application Time (% of replies)*					*Degree of Injury* (No. of replies)*			
	No. Replies	*Spring*	*Summer*	*Fall*	*Winter*	*None*	*Slight*	*Moderate*	*Severe*
Arborvitae	84	73	4	13	11	45	5	4	
Aucuba	26	45	29	16	10	13	4	3	
Azalea/ Rhododendron	103	67	6	17	10	52	8	3	1
Beech	23	83	4	4	9	14	1	2	2
Black walnut	24	50	4	33	12	14		1	1
Cryptomeria	17	72	6	17	6	13	2	1	3
Dogwood	79	73	4	15	8	40	1		
Fir	39	74	8	10	8	20	2	2	1
Gardenia	41	41	15	24	20	14	2	2	1
Hackberry	42	69	7	12	12	28	2	2	
Hemlock	74	72	5	13	11	37	1	1	1
Hickory/ Pecan	29	67	3	10	20	19	1	4	5
Holly	111	53	9	19	19	54	4	2	3
Honeylocust	81	74	5	15	7	49	1		1
Madrone	5	60	20	20		3			
Magnolia	88	64	9	15	13	49	4	3	
Norway maple	56	77	9	5	9	39	2	3	2
Japanese Maple	41	66	15	5	15	18	4	4	5
Silver maple	96	68	8	15	10	49	5	3	2
Sugar maple	63	71	10	8	11	29	7	7	9
Oak	143	66	8	11	15	77	4	2	1
Photinia	30	37	3	37	23	16	4	2	1
Pine	79	66	13	16	5	38	3	1	1
Pyracantha	82	54	10	21	16	45		3	1
Sycamore/ L. plane	50	72	6	12	10	35			
Taxus	98	64	4	21	11	48	2	3	2
Boxwood	72	56	13	18	13	36	2	3	

*Correlation of injury with a particular spray season could not be made due to multiple answers.

estimates that the professional landscape industry uses about 750,000 gallons annually. This does not include oil used by homeowners.

Applicators obtain information on how, when and where to use horticultural oil from the Cooperative Extension Service (33%), label instructions (32%), their supplier (13%), and 21% from other sources.

Phytotoxicity

The survey included a section for recording experiences with oil on 27 landscape plants (Table 3). Of the plants listed, there were no reports of damage to sycamore/London plane. All other plants were reported to have been damaged to some degree (e.g., for dogwood, 98% reported no injury, 2% slight injury, 0% moderate injury, and 0% severe injury; and for sugar maple, 56% no injury, 13% slight injury, 13% moderate injury, and 17% severe injury).

The plants that were most frequently reported to be damaged were: aucuba, cryptomeria, hickory/pecan, Japanese holly, Japanese maple, sugar maple, and silver maple (Table 3). Phytotoxicity was also reported on spruce (mostly Alberta, blue, and white).

Phytotoxicity was rated in general as being limited to marginal burn of leaves from spring and summer treatments and twig dieback from dormant treatments. Summarizing all phytotoxic evaluations for all plants the responses were: 83% no injury, 7% slight, 6% moderate, and 4% severe. One respondent observed that highly pubescent leaves were more likely to be injured; another reported that red and silver maple sprayed immediately following bud break resulted in stunted foliar growth. Responses in regard to the dilution rates used were (gallons oil/100 gallons water): 17% at 1.5 gallons of oil, 51% at 2 gallons, 29% at 3 gallons and 2% at 4 gallons.

There were major differences in phytotoxicity reports within and between regions. In the Southeast, for example, there is an interesting discrepancy regarding the sensitivity of Japanese and Burford hollies. A few respondents indicated no phytotoxicity, but an equal number reported severe defoliation after an application of oil. Several respondents continue to associate summer phytotoxicity with high temperatures, particularly in the north central states. This perception is probably based, in part, on the label admonition to avoid spraying when the ambient temperature is above 85°F. In contrast, one landscape firm in northern Texas uses oil sprays regularly in the summer, even spraying when it is 100°F. One respondent from Colorado reported that label rates were too high for Colorado conditions and usually resulted in foliage injury. He suggested that increased ultraviolet light (associated with higher elevations) may enhance oil-caused phytotoxicity in the Rocky Mountain region.

Misconceptions and Other Uses

While used mostly as a pesticide, numerous references were made to oil's purported value as a sticker/spreader for other pesticides. Some use oil largely because of customer acceptability. "A slight oil sheen adds greatly to the customer's visual approval of the spray job," is a statement made by one respondent. One individual sprays oil with Benlate to control Diplodia tip blight (a foliar and cone disease) on Austrian and mugo pines and says that it has held the disease in check. Another respondent says that oil sprays encourage *Diplodia* on Austrian pine. Several positive comments were made about oil applications removing sooty mold from leaf and twig surfaces.

Through the survey, we found several innovative and unique uses, some of which strained even the most liberal interpretation of the label; others were overt misuses. Observations made by most respondents are not supported by published research, but in some instances their conclusions seemed logical. Some of these were included above with the hope that new research will be initiated to answer many of the questions and eventually establish guidelines for using oil. Even though horticultural oil is one of the safest pesticides, we would caution the innovator that all of the federal and state pesticide regulations apply.

Conclusions

Since 57% of the respondents do not use oil, more research and/or advertising needs to be done so that horticultural oil is considered more frequently as a pest control option. The vast ma-

jority of professionals who use horticultural oil believe they obtain suitable pest control without causing phytotoxicity. Extension personnel have very little current information to disseminate, as most guidelines for oil use are based on work with older oil formulations that are no longer used. Future research must explore proper application timing in relation to phenological development of both plant and pest species, in order to: 1) define the conditions that appear to predispose plants to injury and 2) document efficacy.

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Selected References

1. Chapman, P. J., G. W. Pearce, and A. W. Avens. 1943. *Relation of composition to the efficiency of foliage or summer type petroleum fractions.* J. Econ. Entomol. 36:241-247.
2. Gunther, F. A., and L. R. Jeppson. 1960. Petroleum Products (Chapter 11). **In**:Modern Insecticides and World Food Production. pp. 173-82. John Wiley and Sons, N.Y. pp. 284.
3. Johnson, W. T. 1980. *Spray oils as insecticides.* J. Arboric. 6:169-74.
4. Johnson, W. T. 1983. *New label for spray oil.* J. Arboric. 10:206-7.
5. Meyer, R. H. and R. Randell. 1973. *San Jose scale control with superior oil.* J. Econ. Entomol. 66:1354.
6. Miller, R. L. 1983. *Spray oil insecticides effectively control some insects and mites.* American Nurseryman Sept. 15:37-43.
7. Newbauer, I. and K. Matsumoto. 1981. *Low volume oil sprays to control the soft scale, Ceroplastes floridensis Comstock, in citrus trees in Israel.* Proc. Int. Soc. Citriculture 2:614-15.
8. Simons, J. N. 1982. Use of oil sprays and reflective surfaces for control of insect-transmitted plant viruses. pp. 71-93. **In**:Pathogens, Vectors and Plant Diseases. Academic Press, New York.
9. Stewart, D. 1980. *Control of overwintering pests on dormant fruit trees with Lorsban and oil.* Down to Earth 36(2):2-7.
10. Tippins, H. H. 1973. *Comparison of three types of sprayers for tea scale control.* J. Georgia Entomol. Soc. 8:310-11.
11. Tippins, H. H. 1974. *Nonrelationship between oil sprays and damage to ornamental plants during extreme temperatures.* J. Ga. Entomol. Soc. 9:51-3.
12. Wheeler, E. H. and G. D. Oberle. 1948. *Oils in dormant sprays to control European fruit lecanium and cottony peach scale.* J. Econ. Entomol. 41:186-9.

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