Monsanto

Monsanto Company
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166
Phone: (314) 694-1000

April 29, 1970

Mr. W. C. McCall, President
Great Western Chemical Company
3720 North West Yeon Avenue
Portland, Oregon 97210

Dear Mr. McCall:

You are already well aware of the publicity surrounding the allegations that certain Polychlorinated Biphenyls (PCB) are environmental contaminants. It has been suggested that one possible source of contamination is the use of these materials in pesticide formulations.

Even though the recommendations for the use of PCB in insecticide formulations originally came from the U.S.D.A., Monsanto has written to Dr. Hayes, Director, Pesticide Regulations Division of U.S.D.A. recommending that his department give critical attention to the registration of PCBs as an ingredient of pesticide formulations. We attach a copy of our letter to Dr. Hayes.

Furthermore, it has been decided that effective immediately, Monsanto will discontinue the sale of PCBs to any customer using or intending to use PCB as an insecticide/pesticide carrier. By PCB we mean the members of the Aroclor® 1200 series, namely, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268, and toluol/xylol solutions of 1254, 1260 and 1262, plus Aroclor 4465. As our distributor for these products, we wish to ask for your co-operation in making certain that sales for these applications are discontinued immediately. Please inform us if you intend to comply with this request and also when the necessary action has been taken.

DSW 009652

This ban does not extend to chlorinated terphenyls, namely Aroclor 5060, 5442 and 5460. Nevertheless, we feel that their usage should not be recommended or encouraged further.

What suggestions might we suggest? We suggest formulators may wish to look at:

Santolite® MHP
Santolite MS-80%
Santicizer® 261
Santicizer B-16
Santicizer 8

We wish to point out that we do not recommend a switch to any other product without checking by the customer to obtain U.S.D.A. clearance. This is outside Monsanto's jurisdiction.

We apologize for the trouble and inconvenience this request may cause you but, unfortunately, present circumstances dictate this course. Should any of your location managers and representatives have any questions concerning this matter, the appropriate Monsanto regional manager for the Plasticizer Business Group will be willing to render all possible assistance.

Very truly yours,

W. E. Schalk

W. E. Schalk
Director of Sales
Plasticizers

/dbw

DSW 009653

April 13, 1970

Dr. Harry W. Hayes
Director
Pesticide Regulations Division
Agricultural Research Service
U. S. Department of Agriculture
Washington, D. C.

Dear Dr. Hayes:

Perhaps you are familiar with the current widespread interest in polychlorinated biphenyls and their reported presence in the ecosystem. There are a number of publications that indicate one possible source is the use of these materials in pesticide formulations.

In the early 1950's there were several publications (see enclosed copies of two) which indicated that "chlorinated polyphenyls" improve the residual effect of lindane and possibly chlordane. To our knowledge there was never any recommendation by anyone for their use on food or other crops. The principal application was to spray metal or painted surfaces to increase the effectiveness of the active pesticide against flies, ants, roaches, silverfish, etc.

For a number of years our technical bulletins contained references to reports by U. S. Department of Agriculture scientists that this type of application improved the residual characteristics of insecticides. To our knowledge this usage of the chlorinated biphenyls never developed to a significant degree.

Perhaps you are aware that Monsanto is the sole producer of polychlorinated biphenyls in the United States. Our products are trademarked Aroclors. The polychlorinated biphenyls are represented by our Aroclor 1200 series, e.g. Aroclor 1254 is biphenyl chlorinated to the extent of 54%.

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It is possible that some pesticide formulators are purchasing from our distributors our chlorinated biphenyls for inclusion in their formulations. In view of the concern over the presence in the environment of persistent chlorinated hydrocarbons, we believe that the chlorinated biphenyls should no longer be used in such formulations.

We ask, therefore, as your department considers the re-registration of pesticide formulations, that critical attention be given to the presence of these materials.

We will be happy to discuss this further with you either by letter or personally.

Very truly yours,

R. Emmet Kelly, M. D.
Medical Director

REK:ju

Enclosures

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Purchased by the
United States
Department of Agriculture
for official use

Chlorinated Polyphenyls to Improve Lindane Residues

W. N. Sullivan and Irwin Hornstein, *U.S.D.A. Agr. Res. Adm., Bureau of Entomology and Plant Quarantine*

The use of lindane as a pesticidal residue is well established. On some surfaces the residue is unsightly and it generally dissipates within a few weeks, owing to the relatively high vapor pressure of lindane (9.4×10^{-6} mm. Hg. at 20° C.). Studies were therefore initiated to improve both the appearance and persistence of lindane residues.

Previous work by Block (1948) and Lindquist *et al.* (1945) proved that DDT can be incorporated into resins and paints. We chose to blend lindane with a chlorinated polyphenyl for the following reasons: (1) Chlorinated polyphenyls are obtainable as high-molecular-weight, noncrystallizing, film-forming materials. (2) Since both these materials are chlorinated hydrocarbons, it was expected that lindane would be soluble in the polyphenyl and therefore would show no tendency to crystallize out of such films. (3) The vapor pressure of such mixtures is lower than that of lindane alone, and thus the effective life of lindane would be extended. (4) Chlorinated polyphenyls would not be expected to discolor or change their physical characteristics with time. Paints and polymerizable films such as urea formaldehyde may change in time. Paints may form a hard skin impervious to lindane diffusion, and polymerizable materials, in addition to discoloring, may continue to polymerize and eventually cause the lindane to crystallize out of the film.

Chlorinated polyphenyls are inexpensive, nonoxidizing, of low volatility, noncorrosive to metals, and resistant to fire and water. They are available under the trademark *Aroclor*.[1]

Materials and Methods.—Because of good preliminary results, the chlorinated polyphenyl used in these tests was an isomeric terphenyl (ortho, meta, and para mixture) containing about 60 per cent of chlorine by weight and commercially available as *Aroclor 5460*. It forms a yellow transparent resin with a very low vapor pressure.

Carbon tetrachloride solutions of lindane and the chlorinated polyphenyl, separately and together, were prepared in several concentrations. The test solutions were poured on aluminum and masonite panels each 1 square foot. The spreading properties of the solutions were excellent. The carbon tetrachloride soon evaporated, leaving the lindane as a white deposit, the mixture as a clear residue that was tenacious and slightly tacky, and the chlorinated polyphenyl as a hard, transparent residue. The panels were placed in a horizontal position and held at summer room temperature (70°–100° F.) for 3 months.

Large nymph and adult roaches, *Periplaneta americana* (L.), were used as test insects. After 2, 10, 30, 60, and 90 days, 15 roaches were confined for 2 hours under each of two petri dishes inverted over each test panel. The roaches were thus exposed to the contact and fumigation action of the residues on the test panel. They were then transferred to observation cages and held for 4 days.

Results.—The results of the tests are given in table 1.

The effective life of a lindane residue, as measured by a 50 per cent or better kill of roaches on an aluminum surface, is shown to be dependent on the amount of lindane used. Lindane residues of 50, 100, and 200 mg. per square foot were effective under summer conditions for less than 15, 30, and 60 days, respectively. These were the periods during which the white deposit was visible.

The effective period was greatly increased when lindane was mixed with the chlorinated polyphenyl. A 66 per cent kill was obtained when the roaches were exposed to 30-day-old residues containing 50 mg. of lindane plus 200 mg. of chlorinated poly-

[1] The Aroclors, physical and chemical properties and suggested applications. Application Data Bulletin No. P-118, Monsanto Chemical Co., St. Louis, Mo.

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Days Treated Plants to Intervene	Per Cent Dead After			
	Lindane		Lindane-Aroclor	
	2 Days	5 Days	2 Days	
	Test 1 (Larvae)			
4	70	100	100	
7	65	100	100	
11	70	100	100	
14	45	80	100	
Untreated	10	25[a]		
	Test 2 (Adults)			
8	5	80	100	
36	0	15	100	
Untreated	0	0[b]		
	Test 3 (Adults)			
	1 Day	*3 Days*	*1 Day*	*3 Days*
28	0	60	60	100
35	0	70	70	100
41	0	90	90	100
48	0	0	0	50
65	10	40	40	70
71	0	10	10	80
Untreated	10	20		

[a] The remainder perished within 10 days.
[b] None dead after 7 days.

solved in xylene at the rate of 1 pound of Aroclor No. 5160 to 1.25 pints of xylene and 1 fluid ounce of Triton X-100, added as an emulsifier. This mixture was then added, along with 1 pound of 25% lindane wettable powder, to enough water to make 100 gallons. This gave a suspension containing four parts of Aroclor to one part of actual toxicant.

Prior to carrying out the tests with lindane, it was deemed advisable to determine if Aroclor displayed any toxic properties when used alone. To determine this, a potted elm sapling was sprayed with a suspension of lindane, another with a suspension of lindane and Aroclor, a third with an emulsion of Aroclor, and a fourth with ordinary tap water. The plants were then allowed to dry. Leaves from each lot were removed, placed in separate trays and infested with adults of the elm leaf beetle. Twenty adult beetles were used per treatment, observed closely and their ensuing actions were recorded. The beetles which were placed on the lindane-treated leaves and on the lindane-Aroclor-treated leaves were affected almost immediately. After 1 hour all 40 beetles were on their backs showing only a slight movement of the appendages and after 24 hours all were dead. The beetles which were placed on the Aroclor-treated leaves, on the other hand, and on those leaves serving as the check displayed no ill effects at the end of an hour. At the end of 24 hours, however, those on the Aroclor-treated leaves appeared to have very little control of their movements. At the end of 48 hours they were on their backs but still alive, but were dead at the end of 72 hours, whereas, those serving as the check appeared perfectly normal. The results of this test indicated that the Aroclor formulation acted. In Test 1 all larvae placed on leaves treated with the lindane-Aroclor mixture were dead within 2 days whereas, with lindane alone, 100% mortality was not reached until after 5 days. Results were similar with the adult beetles. Ninety per cent mortality occurred at the end of 24 hours and 100% mortality occurred within 3 days on the leaves treated with the lindane-Aroclor formulation even after 41 days had elapsed between the time of treatment and the placing of the adult beetles on the treated leaves.

On June 12, studies were begun in which small elm saplings growing in pots outdoors were sprayed with solutions of lindane or lindane-Aroclor. All applications were made with a 2-gallon D. B. Smith compressed air sprayer. The plants were sprayed to the point of runoff and then placed on a bench outdoors where they were subjected to the existing weather conditions during the months of June and July. One group of elms was treated with a suspension of 25% lindane wettable powder at the rate of 1 pound to 100 gallons of water while another group was treated with the same suspension to which Aroclor was added. Individual plants within each group were sprayed on different dates in order to provide material suitable for this study. Sufficient Aroclor was not available to treat a third group with an emulsion containing Aroclor alone. Therefore the results presented here give only a comparison between the respective actions of the lindane and the lindane-Aroclor formulations.

On June 28 leaves were removed from the elms of each group, placed in trays and infested with third- and fourth-instar larvae of the elm leaf beetle. Twenty larvae were placed in each tray, an unreplicated test. The results are given in table 1.

Two series of tests were conducted using the adult stage of the elm leaf beetle. On August 7 and again on August 22 adult beetles were placed on leaves removed from previously treated plants. Twenty adults were placed in each tray and, as in Test 1, they were not replicated but there were three replicates of the control or check. The results are also given in table 1.

Perhaps one of the most striking results in the data obtained is the apparent rapidity with which the lindane-Aroclor formulation acted. In Test 1 all larvae placed on leaves treated with the lindane-Aroclor mixture were dead within 2 days whereas, with lindane alone, 100% mortality was not reached until after 5 days. Results were similar with the adult beetles. Ninety per cent mortality occurred at the end of 24 hours and 100% mortality occurred within 3 days on the leaves treated with the lindane-Aroclor formulation even after 41 days had elapsed between the time of treatment and the placing of the adult beetles on the treated leaves.

In summary, the results presented indicate that an increase occurred in the effective life of lindane when Aroclor was added to the formulation. Aroclor when used alone, exhibited a toxic effect on the elm leaf beetle. When it was used in combination with lindane, mortality occurred earlier than from the use of lindane alone. It is possible that the Aroclor might have a synergistic effect on the lindane when the two insecticides are used in combination. Further investigations are needed to determine this point.

References Cited

Benignus, P. G No date. Lindane-Aroclor Combinations. Monsanto Chemical Co., St. Louis, Missouri.

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The Use of Chlorinated Polyphenyls to Increase the Effective Insecticidal Life of Lindane[1]

EDWARD J. DUDA, *Bartlett Tree Research Laboratories, Stamford, Conn.*

The tests described in this paper were designed to investigate the possibilities of extending the effective life of lindane by the addition of a chlorinated polyphenyl to the spray solution. Other research workers, in preliminary studies with cockroaches and house flies, have reported some evidence that there was a marked increase in the effective life of lindane when such material was added to the toxicant formulation (Hornstein & Sullivan 1956, Sullivan *et al.* 1955). From their tests they concluded that the effective life of lindane may be increased 10 to 20 times. Therefore, the author attempted to confirm their results under field conditions with an insect of economic importance to the shade tree field.

The materials selected for testing were 25% lindane wettable powder and Aroclor No. 5460, a chlorinated polyphenyl produced exclusively by the Monsanto Chemical Company (Benignus, n. d.). The insect used was the elm leaf beetle, *Galerucella xanthomelaena* (Schr.).

The resinous Aroclor, which is insoluble in water, was dis-

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[1] Accepted for publication January 3, 1957.

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residues of different ages on aluminum and masonite surfaces.

Dosage (Mg./Sq. Ft.)		Aluminum Surface					Masonite Surface				
		Days					Days				
Lindane	Chlorinated Polyphenyl	2	10	30	60	90	2	10	30	60	90
50	0	100	37	9	4	6	78	0	0	4	0
100	0	100	100	36	3	0	100	19	0	3	0
200	0	100	100	78	22	0	100	78	6	6	0
50	200	88	89	78	80	66	91	8	0	6	0
100	200	91	67	76	92	80	100	17	12	2	4
200	200	88	100	63	66	90	100	30	0	3	0
200	400	93	—	79	96	95	—	—	—	—	—
0	200	0	0	0	0	0	—	—	—	—	—

phenyl per square foot. Residues from 100 mg. of lindane plus 800 mg. of chlorinated polyphenyl per square foot increased the kill to 80 per cent, and residues from 200 mg. of lindane plus 200 mg. of chlorinated polyphenyl increased the kill to 90 per cent. The residues remained transparent, tenacious, and only very slightly tacky. Both lindane and lindane-chlorinated-polyphenyl residues were much less effective on the porous masonite surfaces. Residues of the chlorinated polyphenyl alone on aluminum surfaces caused no mortality.

Discussion.—These tests showed that the persistence of lindane as a residue was greatly improved by incorporation into a film of chlorinated polyphenyl. The lindane in the main body of the film remained in solution and acted as a reservoir. As the lindane evaporated from the surface it was continually renewed by a study diffusion of lindane to this surface. Because the lindane remained in solution, there was no white powdery deposit, which often mars treated surfaces.

The excellent spreading properties of the solutions and the inertness and tenacity of the films suggest further uses in the field of entomology, and they are being investigated.

Literature Cited

Block, S. S. 1948. Insecticidal surface coatings. Soap and Sanit. Chem. 24(2): 138–41, 171.

Lindquist, A. W., A. H. Madden, H. G. Wilson, and E. F. Knipling 1945. DDT as a residual-type treatment for control of houseflies. Jour. Econ. Ent. 38: 257–61.

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