

On July 11 and 12, when the applications were begun, the boll weevil infestations throughout all plots were as nearly alike as is usually true under field conditions. From 28 to 26 per cent of the squares were punctured in the dust experiment and from 28 to 29 per cent in the spray experiment. Practically no square infestation by the bollworm was recorded at this time.

Control of the boll weevil was excellent with all insecticides tested. There was no significant difference between the three dosages of heptachlor (Table 1) or between dusts and sprays. Both boll weevil and bollworm caused excessive injury in the check plots, and the reduction in yields in the two plots were approximately the same. Any difference in yield between treatments was due to soil variations and moisture levels and not to a difference in insect control.

Toward the end of the season aphids became fairly numerous where the spray was applied, probably as a result of the prolonged use of DDT for bollworm control. However, control measures were not required. In the spray experiment the infestation of spider mites was much lower than that of aphids, whereas in the dust experiment the infestations were approximately equal.

SUMMARY.—Two field experiments were conducted at Stoneville, Miss., to determine minimum dosages of heptachlor required for the control of the boll weevil, *Anthonomus grandis* Boh., and its effect on other cotton pests. Tractor equipment was utilized to apply dusts and sprays. Dusts containing 2.5, 3.5, and 5.0 per cent of heptachlor were compared with each other and also with dusts containing 2.5 per cent of aldrin, 1.5 per cent of dieldrin, and impregnated BHC containing 3 per cent of the gamma isomer. There was no significant difference in boll weevil control obtained between concentrations of heptachlor or between heptachlor and any of the other insecticides. To control the bollworm 10 per cent DDT dust was applied in two separate applications.

Emulsion sprays containing heptachlor gave boll weevil control similar to that obtained with dusts in equivalent dosages and equal to that of aldrin and dieldrin. Control with BHC dusts and chlordane sprays was about the same. DDT at the rate of 0.5 pound per acre was included in each treatment from August 2 to September 4 for control of the bollworm. Apparently heptachlor had very little effect on infestations of the cotton aphid and spider mites.

It is concluded from these experiments, and from other observations and tests made in 1949 and 1950, that heptachlor at 0.25 pound per acre in either dust or spray is sufficient for control of the boll weevil under the conditions existing at Stoneville, Miss.

Chlorinated Polyphenyls to Improve Lindane Residues

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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, non-oxidizing, 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 ($70^\circ\text{--}100^\circ \text{F}$.) for 3 months.

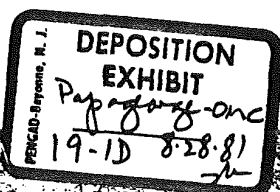
Large nymph and adult roaches, *Periplaneta americana* (L.), were used as test insects. After 2, 10, 30, 60, and 90 days, 15 roaches were confined for 2 hours under each of two petri dishes inverted over each test panel. The roaches were thus exposed to the contact and fumigation action of the residues 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 60 per cent kill was obtained when the roaches were exposed to 80-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-115, Monsanto Chemical Co., St. Louis, Mo.



On July 11 and 12, when the applications were begun, the boll weevil infestations throughout all plots were as nearly alike as is usually true under field conditions. From 23 to 28 per cent of the squares were punctured in the dust experiment and from 23 to 29 per cent in the spray experiment. Practically no square infestation by the bollworm was recorded at this time.

Control of the boll weevil was excellent with all insecticides tested. There was no significant difference between the three dosages of heptachlor (Table 1) or between dusts and sprays. Both boll weevil and bollworm caused excessive injury in the check plots, and the reduction in yields in the two plots were approximately the same. Any difference in yield between treatments was due to soil variations and moisture levels and not to a difference in insect control.

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Table 1.—Per cent mortality of roaches exposed to lindane and lindane-residues of different ages on aluminum and masonite surfaces.

DOSAGE (MG./SQ. FT.)		ALUMINUM SURFACE					MASONITE	
Lindane	Polyphenyl	Days					2	10
		2	10	30	60	90		
50	0	100	37	0	4	0	72	0
100	0	100	100	36	3	0	100	10
200	0	100	100	78	22	0	100	78
50	200	86	89	78	80	66	91	8
100	200	91	67	76	82	80	100	17
200	200	98	100	63	66	99	100	30
200	400	95	—	79	90	95	—	—
0	200	0	0	0	0	0	—	—

phenyl per square foot. Residues from 100 mg. of lindane plus 200 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 99 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 steady 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

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Lindquist, A. W., A. H. Madden, H. G. Wilson, and E. F. Kuippling 1945. DDT as a residual-type treatment for control of houseflies. JOUR. ECON. ENT. 38: 257–61.

Incidence of Forage Crop Pests in Massachusetts and Seasonal History of the Meadow Spittlebug¹

F. R. SHAW, A. I. BOURNE and W. BOYD

During the past season we began some work on the forage crop pests of Massachusetts. Since no records were available of the species of the insects or of their

Our first observations were made on May 5. Pra. Kalt. proved to be the most common insect. However there was parasitism and predation serious. Turnished plant bugs, these were small nymphs.

From May 18 to 22 we were in both the Connecticut County. The insect fauna numbers of species and in very abundant. Spittlebug and *Lygus* bugs were considerable amount of leaf damage of the clover leaf weevil many had been killed by clover root weevils were found lepidopterous larvae were as *Euxoa* sp.

On June 3 we made an alfalfa fields in the C this time some of the field bug nymphs were plentiful somewhat in abundance. abundant in most fields having a relatively large alfalfa. A few membrane *festina*, were observed for alfalfa. Adults of the clover head caterpillar and it found on the flower head.

On June 5 some quant the abundance of spittlebug sented below.

PLANTS	
FIELD	EXAMINED
#1	40
2	75
3	70
4	20

¹ Field on one plant.