Chinch Bug Control with New Insecticides[1]

George E. Gould,[2] Purdue University

A minor outbreak of chinch bugs (*Blissus leucopterus* (Say)) occurred in 1964 in an area along the Indiana-Illinois state line and encompassed parts of Newton and Benton Counties in Indiana and Iroquois County in Illinois. Some 4000 acres of millet planted in old wheat land in early July was destroyed by the feeding of second brood chinch bug nymphs combined with poor growing conditions. The dry weather of the 1964 summer was favorable for a population increase and many adults successfully survived the winter. The early spring of 1965 was wet, but the months of May, June and July were dry with rainfall 4 inches below normal in northwest Indiana and 6 inches below the average in the east-central counties. Thus, by July, isolated outbreaks were observed in the northern third of Indiana, while destructive numbers were found in four counties in west-central and seven counties in east-central Indiana. In most instance, losses were restricted to the outer 5 to 20 rows of corn adjacent to ripening and harvested wheat. These high populations afforded an opportunity to check the effectiveness of dieldrin and to test several of the new insecticides.

The history of the chinch bug in Indiana goes back to 1846 when Ball (1) reported injurious populations in Lake County. In 1881 and 1882, Forbes (10) reported serious losses from Ohio, Posey, Gibson, Greene, Rush, Sullivan, Dubois and Vigo Counties. The big chinch bug year was 1887 when losses to corn, wheat, oats and millet in the midwestern states of Kentucky, Ohio, Indiana, Illinois, Iowa, Minnesota, Wisconsin, Missouri and Kansas were over $60,000,000 (12). Although minor losses occurred at infrequent intervals during the next 34 years, the next year with a noticeable infestation was 1921 when losses were reported in the central and northeastern areas of the State (2). Again, in 1933, conditions were favorable for the insect in Lake, Benton, Newton, Porter, LaPorte, Jasper, Warren, Adams, Allen, Blackford, Jay, Wells, Huntington, Whitley, Noble, DeKalb, Steuben and Elkhart Counties. High temperatures and a shortage of rainfall continued through the summer of 1934 and Davis (3) reported serious damage in 50 counties covering the area north of a line from Knox to Randolph Counties. The author was one of four persons sent out by Purdue to demonstrate construction of creosote barriers. In that year, the Federal Government appropriated $1,000,000 to buy creosote. From this money, Indiana received over 534,000 gallons of creosote and, in addition, purchased 145,000 gallons with State money. A total of 7944 miles of barriers were erected to stop the migration of the bugs. Flint (8) states that the 1934 infestation was as heavy as, and perhaps heavier than that of 1887.

The following year, cinch bugs were not serious, but in 1936, another dry year, the two tiers of counties in northwest Indiana had destructive

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populations (5). Beginning in 1925, Davis published annual summaries of insect problems in the State in the Proceedings of the Indiana Academy of Science. He indicated little or no trouble from chinch bugs from 1937 to 1947 and only light, scattered infestations from 1948 through 1954. Summaries by Osmun (14) since 1956 indicate that chinch bug populations in all years up to 1963 were non-economic.

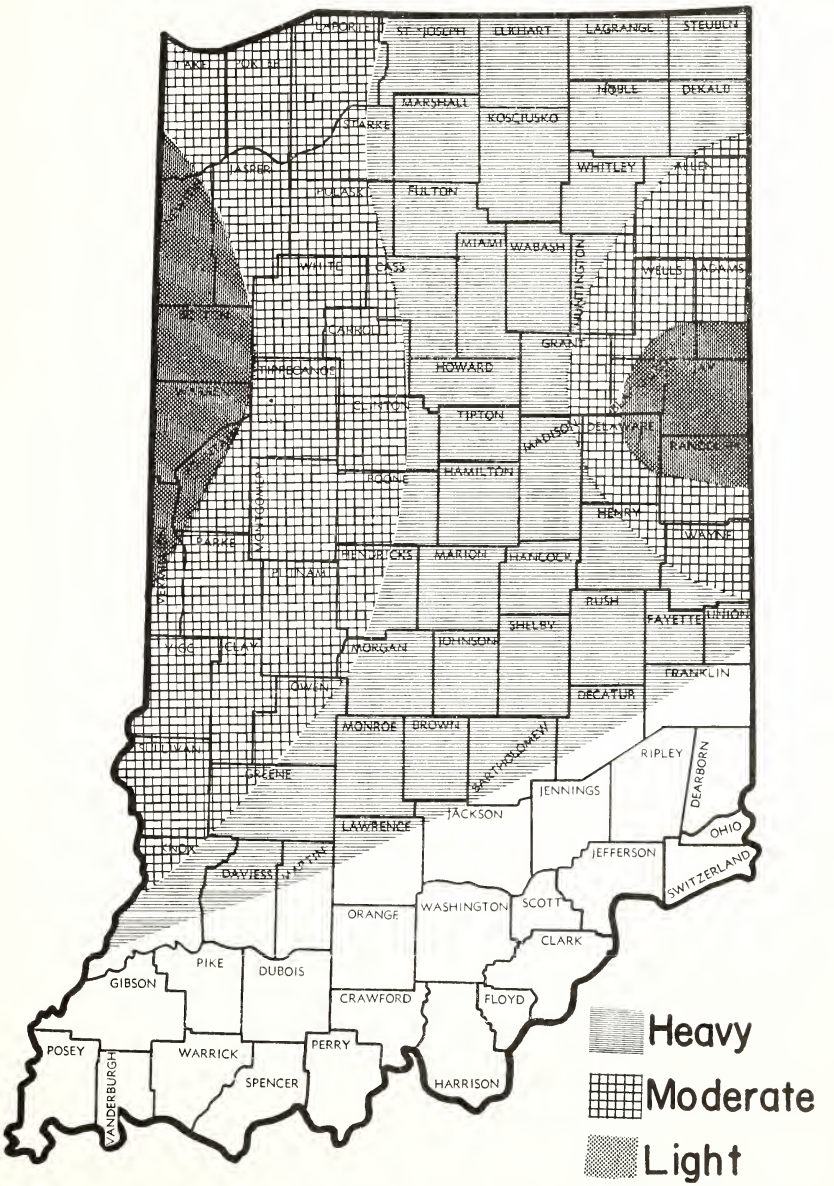

Figure 1. Map of Indiana showing areas of potential damage by chinch bugs, based on populations reported from 1934 through 1965.

Chinch bugs have always been a difficult insect to control. An example of early remedies are those suggested by Gillette (11) in 1888: 1. Plow bugs under 6 inches of soil in early summer; 2. Plow under wheat stubble; 3. Plow in fall and turn soil completely under; 4. Plant millet around small grains and, when infested, cut, plow and drag; 5. Burning of stubble and, in the winter, trash; 6. Grow large-leafed plants to create lower temperatures and unfavorable environment; 7. More manure and less crops; 8. Plant early in spring to shade the soil; 9. Neat farming, no accumulation of rubbish; 10. Unity of action among farmers; 11. Use of kerosene emulsion, coal-tar, gas lime, etc., when they seem likely to be of benefit. An early method for the prevention of migrations was the use of furrows and dust barriers, such as described by Webster (16) of Indiana in 1886.

In the 1920's and 1930's, the burning of chinch bugs in winter quarters was stressed (2, 4). A few years later, burning was no longer approved and the use of chinch-bug-proof crops was recommended (9). The use of dust and creosote barriers continued to rank first in the prevention of migrations and was the principal control measure in the big outbreak of 1934. In the mid-1940's, two toxic chemicals, dinitro-ortho-cresol and calcium cyanide, were used in the form of dust barriers (6).

Through the years, various materials have been used as sprays against chinch bugs, both clustered on the corn plants and crawling on the soil surface. Many formulations of kerosene emulsion were developed and used, but often these sprays did as much damage to the corn plants as did the insects. Richardson *et al.* (15) tested a number of materials and found that pyrethrins, rotenone and nicotine gave better control than kerosene emulsion. Kearns and coworkers (13) found that a new chemical, later called dieldrin, gave excellent kills of the chinch bug. Decker *et al.* (7) tested a number of new insecticides and found their toxicity to chinch bugs ranged in the following order: parathion best, lindane, dieldrin, endrin, aldrin, dinitro-ortho-cresol, heptachlor, dilan, chlordane, toxaphene, DDT and TDE. However, only endrin and dieldrin had sufficient residual action to stop bug migration two to four days after application.

Methods. In late June and early July of 1965, reports from the northern part of the State indicated a general, but light, infestation of the chinch bug. Some corn fields in Newton, Benton and Jasper Counties on the west and in Jay, Adams, Wells and Blackford Counties on the east had populations high enough to damage the crop in 10 to 30 rows adjacent to the wheat. Two such fields near Dunkirk in Jay County and one near Brook in Newton County were selected for testing new insecticides. In the two fields near Dunkirk, corn stands were poor and irregular. The adjacent fields of wheat were ripe but on July 5 had not been harvested. The dry, cracked soil was covered with chinch bugs migrating in all directions. The population was about 10 percent in the adult stage and the remainder evenly divided between the young red nymphs and the older black nymphs. The first two rows of corn were covered with bugs and a fourth of the plants had already been killed. The bugs were

numerous and clustered on the lower stalks out some 20 rows, while beyond that the population was light and scattered. In the field north of Dunkirk, the corn plants on the low land and on the knolls was 3 to 4 feet tall, but on the sloping land, few corn seed had germinated.

During the spring, more rain fell in the Newton County area and consequently the crop was excellent. Plants in the test field were 7 to 8 feet tall, except for the four rows adjacent to the wheat. Plants in rows 1 and 2 showed the effects of chinch bug feeding and were only 3 to 4 feet tall. Most suckers and about a fifth of the plants were dead or dying. Rows 3 and 4 were taller than the outer rows and yet shorter than the remainder of the field. Clusters of bugs were found in to the 20th row and dropped off sharply beyond that. An unusual occurrence in this field was the exceptionally high population of the picnic beetle, *Glischrochilus quadrisignatus* (Say). They were found in the pollen and other debris accumulated at the base of the upper leaves and behind the leaf sheath of the lower stalk along with the chinch bugs. These beetles and the numerous blowflies present were probably attracted by the fermenting juices associated with the feeding of the chinch bugs.

In the Jay County fields, sprays were applied with a tractor-mounted 4-row sprayer. This outfit with 3 nozzles per row and 40 pounds pressure applied 25 gallons per acre. This quantity was sufficient to wet the lower stalk, but was not enough to permit any liquid to run down behind the leaf sheath. In the south field, rows 5 to 8 were treated with dieldrin, while in the north field, diazinon was applied to rows 2-5, carbaryl to rows 6-9, and dimethoate to rows 15-18. Rows 5 and 9 and beyond in the first field and 1, 12 and beyond 18 in the second field were untreated. Treated areas were not replicated.

In all three fields, a knapsack sprayer was used to apply materials to small plots which were two rows wide and 60 feet long. The application rate of approximately 250 gallons per acre was sufficient to wet the bugs and stalk and to permit some material to run down behind the leaf sheath. While this rate was excessive, it would show the ability of the insecticide to give a possible kill. In Jay County, rows 1-4 in the south field and 10 and 11 and 13 and 14 in the north field were used for small plots. In Newton County, treatments were applied to rows 1 and 2 and 3 and 4, while rows 5 and beyond were untreated.

The effectiveness of the treatments were checked approximately 48 hours after the application. An estimation of the efficiency of materials was based on general observations of insect populations and included the following: 1. the number of chinch bugs clustered on the lower stalk; 2. an estimate of dead and live red nymphs on the ground, behind the leaf sheath, or in the whorls; 3. the same for the larger black nymphs; 4. the same for adults; 5. an estimate of live bugs on the ground, especially in the loose soil around roots; 6. an estimate of live bugs hiding under dead plants, suckers and leaves; 7. estimates of numbers of dead and live picnic beetles and other insects including ground beetles, ladybird beetles, fungus beetles and lacewing flies. From these observations, a value was assigned to each plot ranging from 97 for the highest down to 5 for the poorest. Two separate observations were made in

each plot, while in the case of the Newton County field, additional observations were made at 4 and 7 days after the application.

Results. In Jay County, observations 48 hours after treatment indicated poor results from the use of the large sprayer. In general, populations appeared to be lower and clusters of bugs on the lower stalk were gone. However, few dead bugs could be found on the soil or behind the leaf sheath. The ratings given included diazinon 5, dieldrin 20, dimethoate 30 and carbaryl 40. Results with materials applied with the knapsack sprayer were somewhat better and are given in table 1.

TABLE 1

Effectiveness of some insecticides in the control of chinch bugs in Newton and Jay Counties. 1965.

Material	Formulation[a]	Pounds actual toxicant per acre	Ratings[e] Newton Co. July 8	Newton Co. July 10	Jay Co. July 7
NIA 10242[b]	80 WP—C	2.6	97	90	
Parathion	2E—P	1.8	88	90	
Naled	8E—P	1.6	60	70	45
Baygon (Bay 39007)	1.5E—C	1.8	88	90	
AC 52160[c]	4E—P	2.1	40	50	25
AC 52160 + AC 47031[d]	2E—P 2E—P	3.2	52	60	35
Bomyl	4E—P	1.2	12	70	
Dimethoate	2E—P	1.3	25	70	30
Toxaphene	6E—CH	4.7	5	50	
Carbaryl	80 WP—C	2.2	35	45	
Dursban	2E—P	1.8	37	40	
Zectran	2E—C	1.8	35	35	
Matacil (Bay 44646)	80 WP—C	4.5	12	40	
Azodrin (SD 9129)	3.2M—P	1.3	33	30	
Dieldrin	1.5E—CH	1.3	—	—	25

a. Abbreviations: WP wettable powder; E emulsifiable concentrate; M miscible powder; C carbamate; P organophosphate; CH chlorinated hydrocarbon.

b. 2,3-dihydro-2, 2-dimethylbenzofuranyl-7 N-methylcarbamate.

c. 0, 0, 0′-tetramethyl 0, 0′-thiodi-phenylene phosphorothioate.

d. 2-(diethoxyphorphinylimino)-1, 3-dithiolane.

e. The rating scale was 100 for the best control down to 0 for no control.

Observations were also made on the effect of phorate granules on chinch bugs and their migration. The 10 percent granular formulation was scattered over the soil surface between rows 1 and 4 with a small fertilizer spreader. The rate of application was about 4 pounds actual toxicant per acre. Shortly after the application, it was noted that the

bugs tended to avoid the granules, but none were killed. About 40 hours later, 0.75 inches of rain fell and at the time of the 48-hour examination, the odor of phorate in the field was quite strong. The bugs were perhaps scarcer in this area, but no dead were found.

In Newton County, 2 inches of rain fell during a period 6 to 12 hours after the application. At the time of the 48-hour examination, four of the 14 materials showed excellent results. Outstanding insecticides were parathion and NIA 10242, as there was little or no insect activity in their respective plots. In addition, dead chinch bugs of all stages and dead picnic beetles were everywhere, including behind the leaf sheath. After these observations on July 8, the farmer had a commercial operator spray the field with dieldrin with a high clearance sprayer. Counts made on July 10 raised some of the original ratings. However, in the original check plots, few dead chinch bugs were observed, even though the plants had received the dieldrin spray. The surprising observation was the large number of dead or dying picnic beetles scattered throughout the field. It was estimated that there were 50 beetles per square yard, while around one small corn plant near the field's edge were 530.

Several farmers in the Newton County area sprayed the corn rows adjacent to wheat with dieldrin. Most applications were made with low-pressure, low-gallonage sprayers used for weed control. Ten gallons or less of material was used per acre and the resulting control was poor. Some farmers used a second application at a higher gallonage but by that time a general dispersal of the adult bugs and heavy rains prevented further evaluation of the treatments.

Of the 15 materials included in these tests, parathion, NIA 10242 and Baygon gave outstanding results. Four other materials had low ratings after 48 hours, but showed a decided improvement by 96 hours. The poor results with dieldrin in these tests and in farmer applications was probably due to lack of coverage and the lack of exposure to the chemical.

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