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AGRICULTURE

OIL BAITES

for Grasshopper and
Armyworm Control

By M. D. FARRAR, W. P. FLINT,
and J. H. BIGGER

100 Tons
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3088 Tons
were used in Illinois in 1937

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OIL BAITs for armyworm and grasshopper control in Illinois were first tested in 1934. Experiments and the experience of farmers who used these baits soon established a preference for them over baits containing molasses.

In the 1937 state-wide campaign for grasshopper control an oil-bait program was followed. More than 3,400 tons of poisoned bait was spread, about 90 percent of which was made with oil as the binder. Thus this type of bait was given a practical test on some 600,000 acres of the principal Illinois crops.

Farmers liked the ease with which the oil baits could be mixed, stored, and spread, and grasshopper control was in general satisfactory where this kind of bait was used. Another merit of the oil bait was that it caused less injury to tender foliage than did some other kinds of bait.

Oil baits are therefore recommended to the farmers of Illinois because they have satisfactory killing qualities; when properly applied they do not easily injure tender crops; and they are convenient to mix, store, and spread.

Oil Baits for Grasshopper and Armyworm Control

By M. D. FARRAR, W. P. FLINT, and J. H. BIGGER¹

THE DESTRUCTION of farm crops by insects has become a problem of increasing concern during the past decade as drouth years have followed one another in rapid succession. Of the many methods and materials developed or tested for use against grasshoppers, armyworms, and some other cutworms, certain poison baits containing lubricating oils have proved the most effective and practical under Illinois conditions.

TESTS EXTENDED OVER FOUR YEARS

The Illinois experiments with oil baits, briefly summarized in this bulletin, were begun in 1934² and continued thru 1937. They were suggested by work done in the Dakotas³ in 1933. The Illinois field tests were conducted at three places in the state in 1934 on mixed populations of cutworms. An armyworm outbreak in western Illinois in 1935 afforded four additional tests on this pest. Two grasshopper experiments were also made the same year.

The oil baits proved so effective in controlling both grasshoppers and armyworms in 1934 and 1935 that their more general use was recommended to Illinois farmers in 1936, a year when grasshoppers became destructive to farm crops thruout much of the state. Again the oil baits, both experimentally and in the hands of farmers and seedsmen, proved their worth. By means of these baits valuable isolation plots for the production of hybrid corn were saved from serious damage. Altogether about a hundred tons of oil bait was used by Illinois farmers this year.

By 1937 the oil baits had so well demonstrated their value that

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²Bigger, J. H. Preliminary field tests of oil bait for cutworm control. *Jour. Econ. Ent.* **28**, 130. 1935.

³Parker, J. R., Shotwell, R. L., and Morton, F. A. The use of oil in grasshopper baits. *Jour. Econ. Ent.* **27**, 89. 1934.

3,088 tons was reported by the Illinois farm advisers as used in the campaign that year against grasshoppers. This amount of oil bait constituted approximately 90 percent of all the poison bait used. While slightly higher in cost, it was preferred by most farmers to baits containing molasses and water because of its superior mixing, storage, and handling qualities.

OILS OF 20-30 VISCOSITIES MOST SATISFACTORY

Mineral oils with a wide range of chemical properties were tested during 1937. These were obtained from eight different oil companies and included twenty different trade-named brands. The prices of many of these oils are such as to make them practical for use in oil baits.

The most satisfactory oils were mineral oils in the 20-to-30 viscosity range, the higher viscosity giving better results under very dry, hot conditions. Following are the specifications of an oil that was used extensively in these baits and gave good results:

Viscosity SAE.....	20
Specific gravity.....	.9212
Flash.....	365 min.
Fire.....	410-420
Color.....	NPA 4½-5

Vegetable oils, including palm oils, coconut oil, and soybean oil have been tested in baits, but the mineral oils gave better results and are cheaper.

BRAN-COB MIXTURE MADE EXCELLENT CARRIER

As a carrier for the oil and the poison, wheat bran was found to be the best and cheapest material that is generally available.¹ Every elevator and feed store handles it. Farmers can purchase it well in advance of the time when it will be needed for grasshopper baits, and if weather conditions reduce the hoppers so that it is not needed for bait it can be used for feed.

In the search for a still cheaper carrier, tests were made in 1937 of a mixture of bran and corncobs ground to the fineness of bran. No reduction in the efficiency of the mixture could be detected when the ground corncobs and bran were mixed in equal parts. In fact this mixture proved the cheapest and most effective bait tested under Illi-

¹A number of other materials including oat hulls, cottonseed hulls, sawdust, and various other commercial by-products were tested in 1937, but none proved equal to bran.

nois conditions. When, however, the bran-cob mixture was more than half ground cobs, an inferior bait resulted.

SEVERAL POISONS PROVED EFFECTIVE

The most effective poisons used in these baits were refined white arsenic, crude white arsenic, dry sodium arsenite, sodium pyroarsenate, sodium fluosilicate, and paris green. All of these used at 4 pounds to 100 pounds of bran, or a bran and corncob mixture, have given very satisfactory kills. When sodium arsenite is used, only 3 pounds is necessary to 100 pounds of bran and corncob mixture.

Liquid sodium arsenite did not prove satisfactory in the oil baits.

OIL BAITS CONVENIENT TO MIX AND STORE

One of the big advantages in the use of oil baits over those containing water and molasses is that they can be prepared some time in advance. Tests have shown that they can be stored for more than a year without deteriorating.

With oil baits, as with any bait, thoro mixing of the ingredients is necessary in order to obtain good results. The bran and cobs, or bran alone, and the poison should first be thoroly mixed. Then the oil should be added and the whole thoroly stirred until every particle of the carrier is coated with oil.

Storing the mixed bait for a month or more seems to improve it, as the oil permeates more thoroly thru the mixture and in this way a more uniform distribution is obtained.

Any mixed bait should be conspicuously labeled POISON and stored where there will be no danger of its being used for animal feed.

PLANT INJURY WAS LESS WITH OIL BAITS

For grasshopper bait it is very important to use materials that will not burn the foliage of plants when it is sown broadcast over the field. The soybean, one of the principal crops in Illinois, has a very tender foliage, which, in the experience of the authors, is easily burned with liquid sodium arsenite water bait or with the water-molasses poison-bran bait. As shown by extensive field observations, some of the oil baits were much less injurious to this crop than the water baits. The only bait that did not injure soybean plants was a mixture of lubricating oil, bran, and paris green (Table 1).

Any baits used on soybeans should be spread uniformly and at a rate not to exceed 10 pounds to the acre or serious burning may result.

TABLE 1.—INJURY TO SOYBEAN FOLIAGE FROM WET BAIT AND FROM OIL BAIT
(Treatment applied August 10, 1936; plants examined August 15)

Kind of bait (10 pounds applied per acre)		Leaves visibly injured	
Poison (with bran)	Binder	Upper leaves	Lower leaves
Paris green.....	Oil, SAE 20.....	None	<i>perct.</i> 3
Sodium pyroarsenate.....	Oil, SAE 20.....	Light to moderate	60
Paris green.....	Molasses and water.....	Light	60
Sodium pyroarsenate.....	Water.....	Light to moderate	60
Sodium arsenite.....	Water.....	Moderate	55
No treatment.....	None	3

OIL BAITS FOR ARMYWORM CONTROL

During the seasons of 1934, 1935, and 1937 bran-oil baits were used successfully in the control of armyworms. The tests in the fall of 1934 included a series with the yellow-striped armyworm (*Prodenia ornithogalli* Guenée) and the fall armyworm (*Laphygma frugiperda* S. & A.). In 1935 tests were run on the true armyworm (*Cirphis unipuncta* Haw.). The results of the tests in 1934 and 1935 are shown in Table 2.

TABLE 2.—ARMYWORM CONTROL: COMPARISON OF MOLASSES AND OIL IN BRAN
BAITS, EXPERIMENTS IN WESTERN ILLINOIS, 1934 AND 1935

Crops attacked	Poisons tested, 4 pounds per 100 pounds bait	Binder, 2 gallons per 100 pounds bait	Number of tests	Average kill	Relative efficiency
1934: Experiments with yellow-striped armyworm and fall armyworm					
Alfalfa.....	Paris green..... White arsenic.....	Molasses* Molasses }	2	<i>perct.</i> 85.5	83.4
Alfalfa.....	Paris green..... White arsenic..... Sodium fluosilicate.....	Oil, SAE 30 } Oil, SAE 30 } Oil, SAE 30 }	4	81.0	77.1
Alfalfa.....	None.....	None	3	12.7 ^b	0
1935: Experiments with true armyworm					
Corn, rye, wheat.....	Paris green.....	Molasses*	3	67.0	62.3
Corn, rye, wheat.....	Paris green..... Sodium fluosilicate.....	Oil, SAE 30 } Oil, SAE 30 }	18	69.4	65.0
Corn, rye, wheat.....	None.....	4	12.5 ^b	0

*These baits contained 10 gallons of water to 100 pounds of bait.

^bNatural mortality.

Altho present in smaller numbers, other species also were killed by the baits. These were the corn ear worm (*Heliothis obsoleta* Fab.), alfalfa caterpillar (*Eurymus corytheme* Bdv.), and alfalfa looper (*Autographa californica* Speyer). A few garden webworms (*Loxostege similalis* Guenée) were also killed where the bait was used in alfalfa, but satisfactory control of any of the above species was not obtained.

No experiments in armyworm control were conducted in 1936. In 1937 the work was confined to field observation made in cooperation with more than a thousand farmers. In this year farmers thruout the state used oil baits in combating general outbreaks of this insect. Lack of control was encountered only in one section where a certain cheap oil having a very pronounced odor was used against the true armyworm. The armyworm larvae would not eat bait made with this oil, and farmers made rapid shift back to the bran-molasses bait. Oil from the same lot was used successfully in grasshopper bait.

TABLE 3.—GRASSHOPPER CONTROL: SUMMARY OF EXPERIMENTS WITH OIL BAITS USED AGAINST MIXED POPULATIONS OF GRASSHOPPERS
(All lubricating oils included here are available commercially)

Crops	Bait mixture		Binder	Number of tests	Average kill	Relative humidity
	Base	Poison				
<i>1935</i>						
Soybeans.....	Bran.....	Paris green.....	Molasses and water	1	70 ^a	100.0
Soybeans.....	Bran.....	Paris green.....	Oil, SAE 20-30	2	70 ^a	127.0
<i>1936</i>						
Bluegrass, clover.....	Bran.....	Paris green.....	Molasses and water	3	70 ^a	100.0
		Sodium pyroarsenate.....	Molasses and water			
Bluegrass, clover.....	Bran.....	Paris green.....	Oil, SAE 20	3	70 ^a	113.0
		Sodium pyroarsenate.....	Oil, SAE 20			
Clover.....	Bran and sawdust	Liquid sodium arsenite.....	Water	1	90.0	99.2
Clover, alfalfa.....	Bran.....	Paris green.....	Lubricating oils	6	87.5	96.3
		Sodium pyroarsenate.....	Lubricating oils			
<i>1937</i>						
Roadside.....	Bran.....	Sodium arsenite..	Molasses and water	2	92.5	101.8
Field and laboratory...	Bran.....	Paris green.....	Lubricating oils	27	89.3	98.5
		White arsenic...	Lubricating oils			
		Crude arsenic...	Lubricating oils			
		Sodium pyroarsenate.....	Lubricating oils			
Field and laboratory...	Bran and ground cobs...	Paris green.....	Oil, SAE 20)	4	93.5	104.5
		Crude arsenic...	Oil, SAE 20)			
Weed border.....	Bran.....	Sodium arsenite..	Oil, SAE 20	12	60.0 ^b	66.0

^aNo actual count, estimated from observation.

^bThis series of tests was made on an area infested with newly hatched grasshoppers, where replacement was constantly occurring.

The 1937 observations indicate that oils that are to be used in combined armyworm and cutworm bait should be of a quality marketed as commercial lubricating oil with a viscosity rating of SAE 20 to 30.

OIL BAITS FOR GRASSHOPPER CONTROL

For the control of grasshoppers, baits containing lubricating oils proved as effective as baits containing molasses and water or water alone (Table 3). The quality of the lubricating oil is, however, an important factor in its effectiveness. Oils that should *not* be used are: crankcase oil; reclaimed crankcase oil; fuel oils; oils of SAE 10 or less, which are in the class of floor oils; oils with a high sulfur content, and oils having a pronounced odor.

The following oil-bait formula was successfully used by several thousand Illinois farmers:

Base (bran, or bran and ground corncobs in equal parts).....	100 pounds
Poison (white arsenic or other poisons, see page 417).....	4 pounds
Lubricating oil, SAE 20-30.....	2 gallons

Advantages of oil baits for grasshopper control

1. Control is satisfactory.
2. Materials are available everywhere.
3. The materials or the prepared bait can be stored over long periods.
4. Properly applied, these baits are not so likely to cause injury to tender crops as are other kinds of bait.

Disadvantages of oil baits for grasshopper control

1. Cost per pound is slightly higher.
2. An oil may be obtained that is not satisfactory.



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