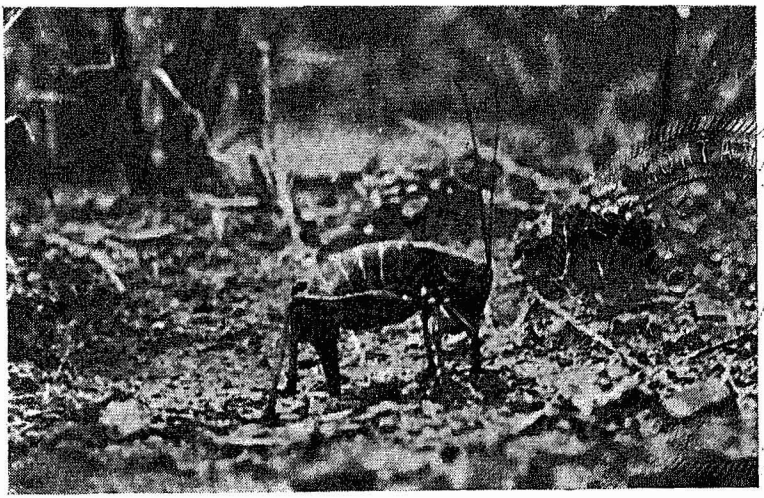
Bulletin No. 160 January, 1938

Control of Mormon Crickets in Montana



Female Mormon Cricket laying eggs.

By

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Montana Extension Service in Agriculture and Home Economics, J. C. Taylor director. Montana State College and United States Department of Agriculture cooperating. Acts of Congress, May 8 and June 30, 1934.

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H. B. Mills, State Entomologist

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INTRODUCTION

The Mormon cricket, (*Anabrus Simplex*), a native insect of the western states, first made its appearance as a menace to crops in 1847 in the state of Utah. It has since been reported in some numbers from the states of Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Utah, Colorado, South Dakota, and North Dakota. It has periodically appeared in Montana in numbers sufficient to attract attention since the beginning of the present century. Apparently it inhabits localized areas in periods of low numbers, but when conditions favoring its development occur, it increases rapidly and migrates from its typical foothill-broken land home, and infests lower, more level areas which are often cropped.

The present infestation dates back to 1931 when swarms of crickets migrated out of the Pryor Mountains in Big Horn county. In 1932 they decreased considerably in this area, but in the north-central part of the state they appeared in some numbers. In 1933 the Big Horn area was again heavily infested, considerable migration took place, and crops were attacked. In 1934 the Indian service extended control operations which were inaugurated in 1931, and although some crop damage was prevented, eggs were laid over a large area.

In 1935 and 1936 control measures were sporadic and at the same time crickets greatly increased throughout the central third of the state, although in 1936 there was a definite decrease in Teton, Pondera, and Glacier counties. West of the divide, crickets

increased in alarming numbers in Lake, Sanders, Madison, Jefferson, and Beaverhead counties. In the autumn of 1937 it was doubtful if a single county in Montana was without some cricket population, and foci, or centers of infestation, seemed to be along the south state line from Carbon to Powder River counties, in the vicinity of Highwood, Little Rocky and Bearpaw Mountains, and in Lake and Sanders counties.

Appearance and Life History

The Mormon cricket is a large, wingless or nearly wingless, grasshopper-like insect. The adult is usually shiny black, but may vary considerably in color, some specimens being green, and others various shades of brown. The antennae are very long and slender, a condition which is not met with in any of the true grasshoppers. Adult specimens may be from one to two inches long, exclusive of the long egg-laying spear or ovipositor, which only the female possesses.

This insect should not be confused with the smaller three-lined bush katydid (*Steiroxys trilineatus*) with which it is occasionally found, and to which it is related. The three-lined bush katydid is about half the size of the Mormon cricket, gray-brown in color, with broken and sometimes indefinite strips down the back. At least up to the present this insect seems to be limited to the margins of woodland and to open parks at higher elevations. During the past few years it has increased tremendously in numbers and if it continues to increase it may in the future be of some economic importance itself.

The Mormon cricket usually lays its eggs (see cover) from the middle of June to the latter part of August, depending naturally on the season. The eggs are deposited separately, although a female may lay several eggs at one spot without withdrawing the ovipositor completely from the soil. A firm, light soil, with a south, east, or west exposure seems to be preferred by the females, which are laying eggs. The eggs are usually placed at a depth of from three-fourths to one and one-fourth inches. When first laid they are brown, turning gray in the soil. They are elongate, with rounded ends, measuring approximately one-quarter of an inch in length.

Development of the embryos within the eggs start shortly after the eggs are laid, and by the time winter sets in they are apparently completely developed, although fall hatching is not known to occur. Because of this fall development, cricket eggs hatch comparatively early in the spring. Hatching has been reported in Lake county as early as the last of February, although general hatching over much of the state does not usually occur until the first of April.

Newly hatched nymphs are light brown in color, changing in a few hours to dark brown or black, with two light stripes down the back. A white line is also present around the edge of the large shield directly behind the head. These nymphs shed their skins seven times, at intervals of from seven to ten days, before reaching the adult stage. They vary considerably in color, even more than do the adults. Some adults appear about two months after the first hatching. Egg laying starts from ten days to two weeks after the adult stage is reached.

Behavior

The Mormon cricket possesses a number of peculiar habits which must be taken into consideration in any control campaign. Very soon after hatching the tiny nymphs start to congregate in bunches in protected places. This "bunching" habit continues throughout the season and seems to be dependent on certain external factors. As the temperatures drop toward evening, clusters begin to form, and with rising temperatures in the morning they break and the individuals scatter. In mid-summer, when temperatures during the middle of the day are excessive, there is another tendency toward grouping together.

Another interesting and important habit of these insects is that of migrating in bands. The band may be a hundred yards or several miles in diameter, and all of the individuals in a given band have a tendency to travel in the same direction. The stimulus which initiates these migrations is not known nor is it possible to determine why a band moves in a definite direction. During the course of a day they may be noted migrating in several directions in the same general locality. The only generalization which may be made concerning these group movements is that during

periods of increasing populations there seems to be the tendency to move out of higher broken land, down watersheds to lower country.

Mormon crickets are highly cannibalistic, and injured individuals are quickly devoured. As a general thing they prefer plants with fleshy leaves. Such plants as dandelions, mustards, bitterroot, young Russian thistles, alfalfa, sweet clover, sugar beets, and most garden truck are readily attacked. The greatest financial loss which is caused by these insects is that brought on by injury or destruction of small grains. From the time of the first migrations into grain fields until harvest, these crops may be injured. The small plants may be entirely eaten down, and headed grain may have the kernels stripped from the heads (figure 1). This latter type of injury is often noticed on native range grasses.

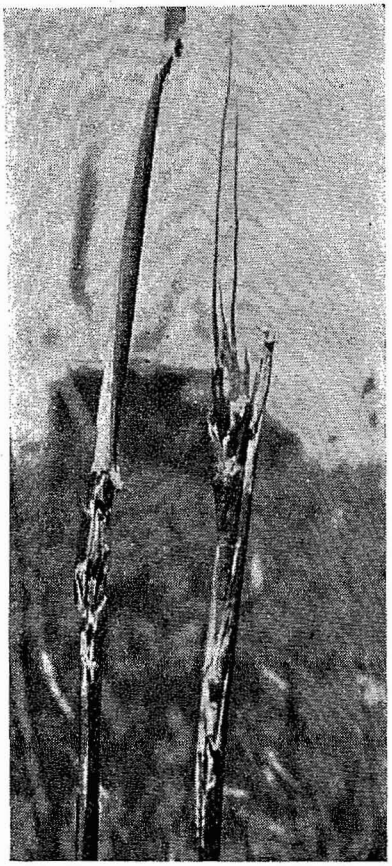

Figure 1. Mormon cricket injury to wheat in the boot.
(Courtesy U. S. Bureau of Entomology and Plant Quarantine).

The attacks of Mormon crickets on crops are highly unpredictable. They may pass through a field without stopping to eat, only to return the next day to completely destroy the crop; or they may stay in a field for some time. Migrating crickets seldom attack crops while they are on the move. The time of feeding depends largely on temperature, but roughly there are two periods of feeding during the day: first, from the time the bands scatter in the morning until approximately 11 a. m., and second, from 4 or 5 p. m. until dark.

Naturally, changes in temperatures would cause considerable variation in the duration of these periods.

Natural Control

When crickets are abundant, they form a considerable item of food for all mammals and birds which include the larger insects in their diets. Some of the more common Montana birds which have been recorded as destroying Mormon crickets are gulls, grouse, hawks, magpies, ravens, crows, meadowlarks, blackbirds, and robins. Domesticated poultry often consume large numbers. Coyotes and even black bears have been noted to eat them in quantities, and doubtless other partially insectivorous mammals, such as skunks, take their toll. Among domesticated mammals, hogs will devour them greedily, and sheep have been reported as eating them.

A tiny, elongate, black wasp (*Sparaison pilosum*) parasitizes the eggs of Mormon crickets, and sometimes destroys them in large numbers. A large wasp (*Palmodes laeviventris*) has been seen to paralize crickets with its sting and to provision its nests with them. Tiny red mites are often found attached to crickets, but so far as is known they injure them very little.

Occasionally Mormon crickets are found to be parasitized by an elongate threadworm. Some of these worms, when uncoiled, may measure two or three feet in length. These parasites would be of considerable value if they were abundant in any area.

During the course of the present infestation, no one of the predators or parasites which attack the crickets has been sufficiently abundant to have other than a very local effect on them.

Artificial Control

Sodium arsenite dust—Dusting Mormon crickets with a mixture of dry sodium arsenite and some fine, inert diluting dust, such as hydrated lime or diatomaceous earth, is at present the most successful means of control. The following formulae have worked satisfactorily in the field:

Sodium arsenite.....1 part
Hydrated lime.....4 parts

or

Sodium arsenite.....1 part
Diatomaceous earth.....3 parts

In several respects the diatomaceous earth is preferable to the lime. It is lighter and fluffier and less of it is necessary in the mix. Further, dust containing the earth is not so irritating to the skin, and it reduces the possibility of injury to men who are mixing or applying it. Actually it is cheaper to use than hydrated lime.

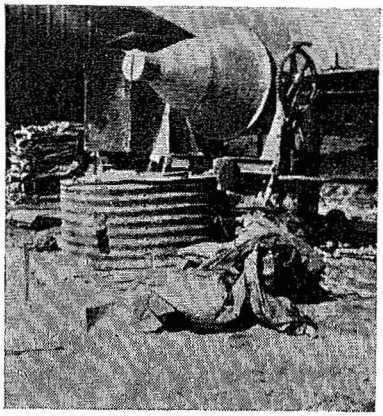

Figure 2. Modified concrete mixer in correct position for dust mixing.

Dust is best mixed in a concrete mixer to which has been fastened a dust-proof hood (figure 2). The hood, which can be made of sheet iron, is in the form of an inverted funnel, the apex, or small end of which is extended into a short tube approximately 10 inches long and 8 inches in diameter. A close-fitting cap can be made which will fit tightly into the end of the tube and the whole hood should be bolted or riveted tightly to the mouth of the mixer so that no dust will escape. A rubber or heavy canvas tube can be made which will fit loosely over the mouth of the hood, and through which the mixed dust can be emptied into containers (see figure 3).

Figure 3. Emptying mixed dust from mixer. Notice platform for refilling in background.

Such a mixer will be practically dust proof, there will be very little loss of material when the mixer is emptied, and refilling will not be difficult. Any wide-mouthed funnel which will fit into the mouth of the hood will suffice for refilling. This funnel should be at least two

feet in diameter so that the materials may be poured into it with a minimum of spilling.

When a concrete mixer is used the drum should be rotated at as great an angle as is possible. In order to obtain a good mix the drum should not be over half full, and it should be allowed to turn about 20 minutes. The dust should be transported in covered drums, heavy paper or tightly woven cloth sacks, and should be kept dry.

Another type of mixer can be used for small quantities of dust. This consists of an oil drum through which a metal axle is placed. The axle should run lengthwise and diagonally through the drum, and be tightly welded to it. It should be sufficiently long so that it can be fitted into bearings in a frame and one end can be bent in the form of a crank. An opening ten inches square should be cut into the side of the drum near one end in such a position that all of the dust can be easily emptied after mixing. A tightly fitting door should be fastened over the opening so there will be no loss of dust during rotation. Such a machine should be turned very slowly.

Dust is applied in the fields by means of dust guns, of which

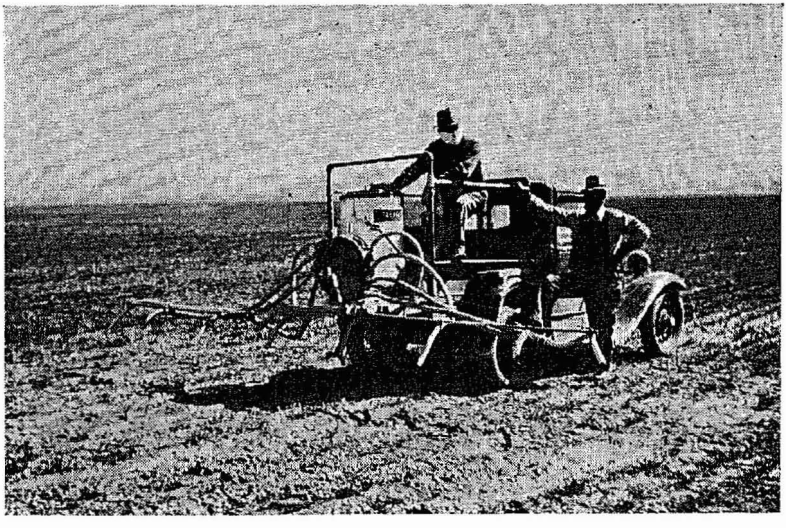

Figure 4. Power duster mounted on back of pickup truck. (Courtesy U. S. Bureau of Entomology and Plant Quarantine).

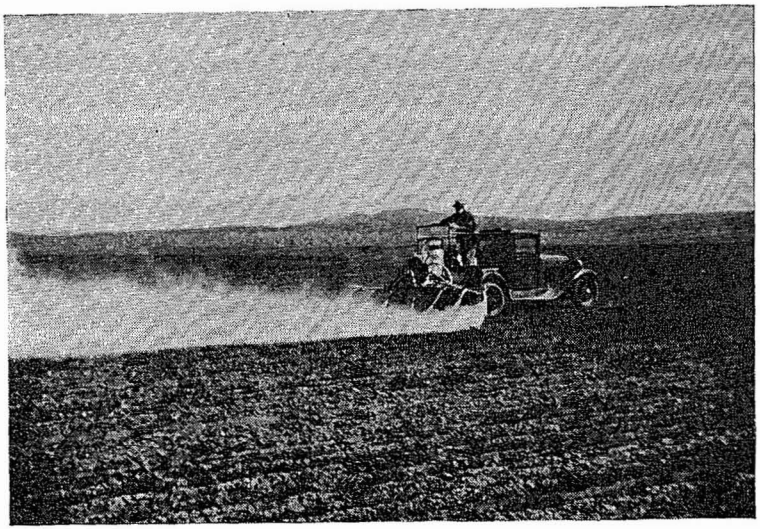

Figure 5. Power duster in operation.
(Courtesy U. S. Bureau of Entomology and Plant Quarantine).

several kinds are on the market. Hand guns can be used where labor is available, and they are the only ones which can be utilized in rough country. Power dusters cut the cost of distribution greatly where the terrain is sufficiently level for their use.

A duster powered by a five-horsepower motor, with eight outlets spread across a 20-foot boom, and mounted on the back of a pickup truck, has been used very successfully in the Yellowstone valley (figures 4 and 5). The length of the boom would depend on the roughness of the country to be covered. When driven at a speed of from 15 to 20 miles per hour such a machine can cover a considerable acreage, and can do the job more efficiently than a large crew of men furnished with hand guns.

Dust is usually spread at a rate of about eight pounds to the acre, and after an area is dusted, the poison mixture should be barely perceptible on the vegetation. Apparently the dust actually has to strike the crickets. Crickets passing through vegetation dusted at the usual rate are not likely to be injured, and where more than this amount is applied there may be danger to livestock.

Where a crew of men is working, care must be taken to keep the men out of the dust. They should travel across the wind, and

never in a straight line. They should line up six or eight feet apart, and the first man to start should be the farthest down the wind. When he has progressed for 10 or 15 feet the next should start, and so on (figure 7). In this way no one is exposed to the dust from any of the guns.

Figure 6. Loading hand dusters in the field. Loading done in a trailer to eliminate spilling dust on the ground.

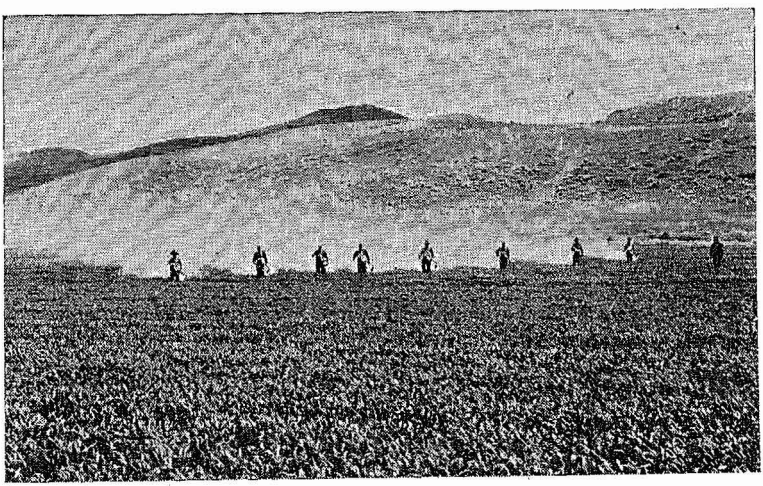

Figure 7. Proper arrangement of dusting crew. No one is exposed to the dust.

While is is possible to dust in a moderate breeze when a power duster is used, hand dusting is very inefficient when a wind is blowing. For this reason, and because of the crickets' habit of banding during the night (except during hot weather), early morning and evening dusting is best when hand dusters are employed. However, dusting may be successful at any time of the day if the crickets are present in some numbers, and if there is little wind blowing.

Dust should not be applied in vegetation which is wet from rain or heavy dew. Workers, whose clothing is wet, are more susceptible to arsenical burning. Applications under such conditions will also result in a considerable amount of poison adhering to the wet plants, and this is not desirable.

Precautions

Arsenite dust is unpleasant to handle and may be dangerous to anyone coming in contact with it. The following precautions have been suggested by the United States Bureau of Entomology and Plant Quarantine:

1. **Change clothes and bathe immediately upon coming in from the field. In bathing use plenty of water and soap. This is the simplest and best safeguard that can be easily observed in preventing arsenic burns and more serious complications.**
2. Wear at least a six-inch top shoe and tie the pant legs down over the tops.
3. Underwear should be worn at all times while workers are handling arsenite dust.
4. Leave as little skin exposed as possible.
5. In order to exclude the dust from the breathing passages, a mask made of cellucotton and gauze may be worn. The masks should be changed every day or when they become saturated with the dust. The common types of rubber respirators are not suitable since they cause the skin to perspire too freely around their edges and induce burning.

6. Dust goggles may be worn if desired.

7. Keep the hands, arms, face and any other exposed skin surface covered with talcum powder while dusting. This helps to keep the skin dry and prevents irritation. **Do not use face cream or other greasy preparations.**

8. Learn to take advantage of the wind while dusting in order to keep out of the dust as much as possible.

In case burning or irritation results in spite of the precautions given above, the following simple treatment will prevent serious results:

1. After bathing, treat all tender or irritated spots with a saturated solution of sodium hyposulphite (photographers' hypo) or a strong solution of baking soda. Apply either of these liberally with a piece of cotton and let dry.

2. Keep the irritated portions well dusted with zinc oxide powder. This material has proved more satisfactory than the ointment.

3. Avoid violent exercise that might irritate the tender parts.

The above treatment is recommended by physicians for arsenic burns and can be followed without fear of any complications arising.

In cases of severe burning a reliable physician should be consulted. However, if the above precautions are strictly adhered to, this should not become necessary.

Injury to Livestock

Sodium arsenite is highly poisonous to all forms of livestock and at times it may be actually attractive to domesticated animals, especially if they are salt hungry. However, no authenticated case of livestock loss has been reported where dusting instructions have been followed. Many instances of stock loss have been noted, but in each this was due to improper handling of the dust. **Dust should never be allowed to accumulate in the fields in piles.** Containers should never be placed so that stock can get to them.

It should be kept in mind that a field should be dusted so that the white dust is **barely perceptible** on the vegetation. More than this amount wastes materials, may be injurious to vegetation, and may injure livestock grazing the area later.

Barriers

Metal Barriers—When bands of crickets are migrating it is often possible to destroy large numbers of them, and protect crops from injury by erecting barriers in their paths. Several types of barriers have been tried, but the most successful consists of a strip of galvanized sheet iron, at least 10 inches high. Twenty-eight or 30 gauge valley tin 10 inches wide and in strips 100 feet long is effective and comparatively easy to erect. Such a metal sheet should be placed tightly against the ground, and banked with soil at the back side. It should lean slightly toward the side from which the crickets are approaching. All stakes which are used in holding the barrier erect should be driven on the side away from the crickets. Vegetation should be cleared away, and in no case should it overhang the barrier.

When the crickets are stopped by the barrier, they move along it seeking an opening. To catch them, traps should be built into the barrier at about 100-foot intervals.

There are several effective barriers. The traps shown in figure 8 are merely metal enclosures built at about 100-foot

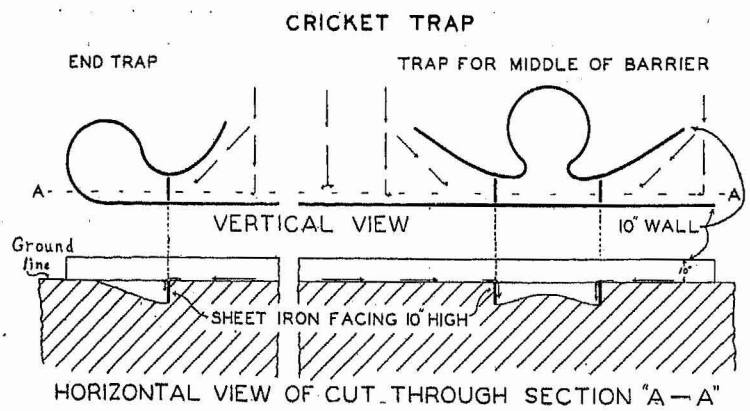

Figure 8. Diagram of cricket traps for use with barrier.

intervals along the barrier and at both ends. On the right of the picture is a trap suitable for any place along the barrier except the ends.

This trap is built of valley tin **on the cricket side** of the barrier. It is nearly circular in shape except for wings that bend away from the barrier and serve to steer the crickets into the trap. Notice the gap on both sides of this trap where crickets enter.

To prevent crickets leaving the trap, a shallow pit is dug. This small pit has a straight side 10 inches deep, faced with tin, as can be seen in the lower half of the figure. Crickets entering the trap, as shown by arrows, fall down this steep side into the trap. They cannot climb up the 10-inch tin wall.

The trap shown on the left is for both ends of the barrier. It is similar to the other traps except that crickets can enter only from the one side.

The crickets thus caught may be destroyed periodically by burning or dusting.

Pit traps are also reasonably successful. Pits 3 feet wide, 3 feet deep, and 4 or 5 feet long may be dug directly beneath the barrier. Strips of valley tin should be placed around the edges of the pits, and slightly overhanging them. (See figure 9).

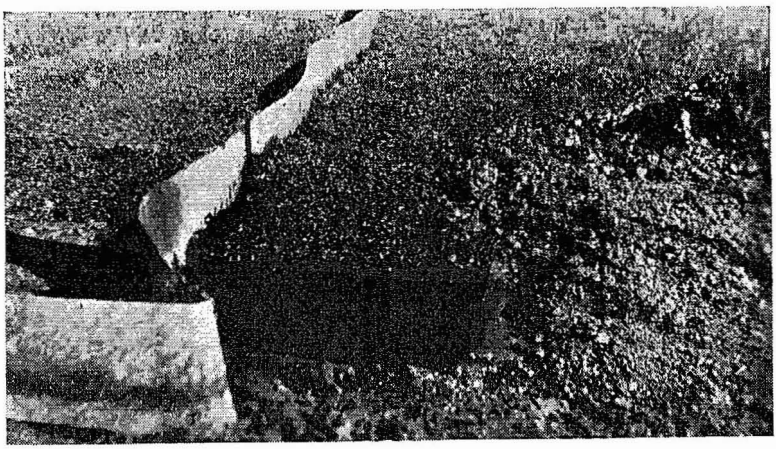

Figure 9. Pit trap.
(Courtesy Keith Sime, Yellowstone County Extension Agent).

Another type of pit which was used in Chouteau County in 1937, consisted of an oil drum cut in half lengthwise. Half of this drum was imbedded beneath the barrier, flush with the surface of the ground. Water, surfaced with oil, was placed in the drum, and crickets following the barrier hopped in and were coated with oil. Any kind of oil on their bodies will kill them (figure 10).

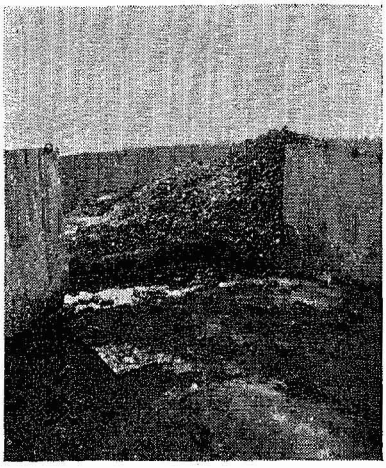

Figure 10. Crickets entering drum trap filled with oil-surfaced water.

It will be necessary to clean these traps occasionally. Other than for trap cleaning and inspection trips workers should stay away from the barriers, in order to disturb the migrating bands as little as possible.

It is often possible to herd bands of crickets into the barriers by dusting behind them and slowly pushing them toward it.

Furrow Barriers—The furrow barrier is not so effective in halting crickets as is the metal barrier, but it is considerably cheaper, and often will kill a good percentage of them. Furrows should be plowed before moving bands or about fields which may be invaded, throwing the soil toward the crickets, and making it necessary for them to crawl up the vertical side of the furrow. In certain types of light soils, such a furrow will stop large numbers. The furrow should be dusted heavily with sodium arsenite dust, so that the crickets entering will be sure to get dust on their bodies. This type of barrier has its limitations. In the first place, livestock may be injured if such a furrow, heavily dusted with sodium arsenite, is not fenced off. Rains may pack or leach the dust so that it is no longer effective, and winds may blow the poison away or cover it with soil.

Oil Barriers—Recently Mormon crickets have migrated to the edges of irrigated sections of high production. The great

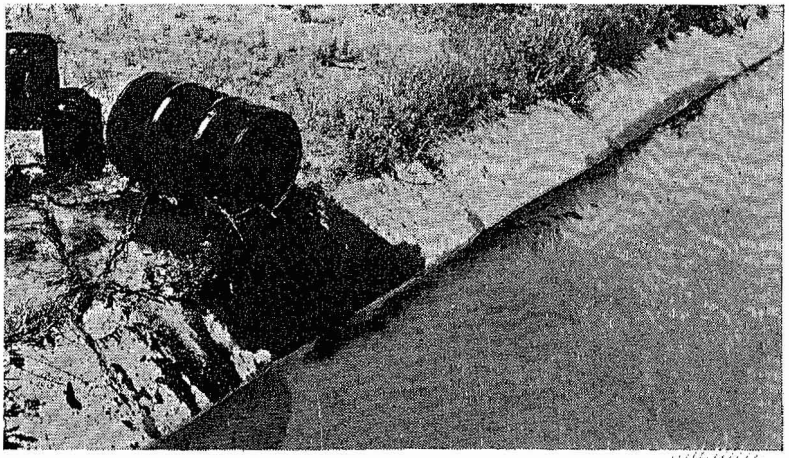

Figure 11. Oil drip for irrigation ditch.
(Courtesy U. S. Bureau of Entomology and Plant Quarantine).

majority of these bands have been kept out of these areas by the oiling of the water in the upper ditches and in bordering streams. This type of barrier is simple, cheap, and highly effective. Any good grade of crude oil may be used for this purpose. A constant stream of oil about the size of the lead in a pencil is usually sufficient to treat a ditch 10 feet wide (figure 11). The influence of this treatment may be evident for at least a mile below the point of application, but this distance will vary with conditions such as overhanging and trailing vegetation, the spread of flow, etc.

A small amount of oil running into the laterals will not injure growing crops, but it can be kept out so easily that none need be allowed to accumulate in the fields. A board placed across the headgate will effectively skim off the oil and dead crickets, and the water will be drawn into these branches from beneath the surface. It should be kept in mind that it is unnecessary to use much oil. A thin film is just as effective as a heavy one. A number of small streams of oil running into a ditch at intervals may be more effective than larger ones separated by greater distances.

Such a barrier is naturally effective only where the water is running in open ditches. If it is carried across coulees in flumes

or siphons, these represent breaks in the barrier and strips of metal should be used to close these gaps.

Overhanging vegetation which might serve as bridges should be cleared from the sides of the ditches.

Burners

Burners have been used to a considerable extent in the control of Mormon crickets. Their use is limited, however, and they will be found of greatest value when the crickets are small, well bunched, and in isolated areas. They may also be employed when the vegetation is too wet to dust. They are more expensive to operate than dust guns, will cover a smaller area in the same length of time, and will destroy the vegetation treated.

Baits

Modified grasshopper baits were first used for the control of Mormon crickets in Montana over ten years ago, and they have been used to some extent in control campaigns since that time. Their effectiveness is highly erratic and no bait developed thus far has shown promise in field tests. The usual grasshopper bait with double the amount of arsenic and 5 pounds of salt added to each 100 pounds of bran, has been used considerably.

While the use of bait is not to be recommended where better control means are available, the development of an effective bait would greatly simplify control operations.

Organization

The present means of control of the Mormon cricket necessitate a high degree of coordinated action in infested areas. During heavy infestations a campaign requires that many men work in the field, unless funds are available and the terrain sufficiently level for the use of power dusters.

When field crews are to be used, an area should be organized well in advance of the beginning of work. An effective type of

organization, based on that which was generally used in Montana during the campaign of 1937, is as follows:

1. State Leader. In charge of general policy and co-ordination of work.

2. Assistant State Leaders. Preferably one for each general division of the state, to be in charge of field operations in his area.

3. County Supervisor. In charge of action within the county, and responsible to the assistant state leader in his region.

4. District Supervisors. In charge of control operations within restricted areas in a county and responsible to the county supervisor.

5. Crew Foremen. In charge of crews which are actually doing the field work. These men see that the control operations are carried out according to directions, locate bands of crickets, etc., and are responsible to the district foremen.

6. Crews. The size of crews varies with the intensity of the local problem. They operate dust guns, keep the barriers, scout for bands, etc. and are under the immediate supervision of the crew foremen.

It is extremely important that a large amount if not all of the materials needed be **on hand** at the beginning of the control season. Unless this precaution is observed valuable time at critical periods may be lost and land cleared of crickets may be reinfested.