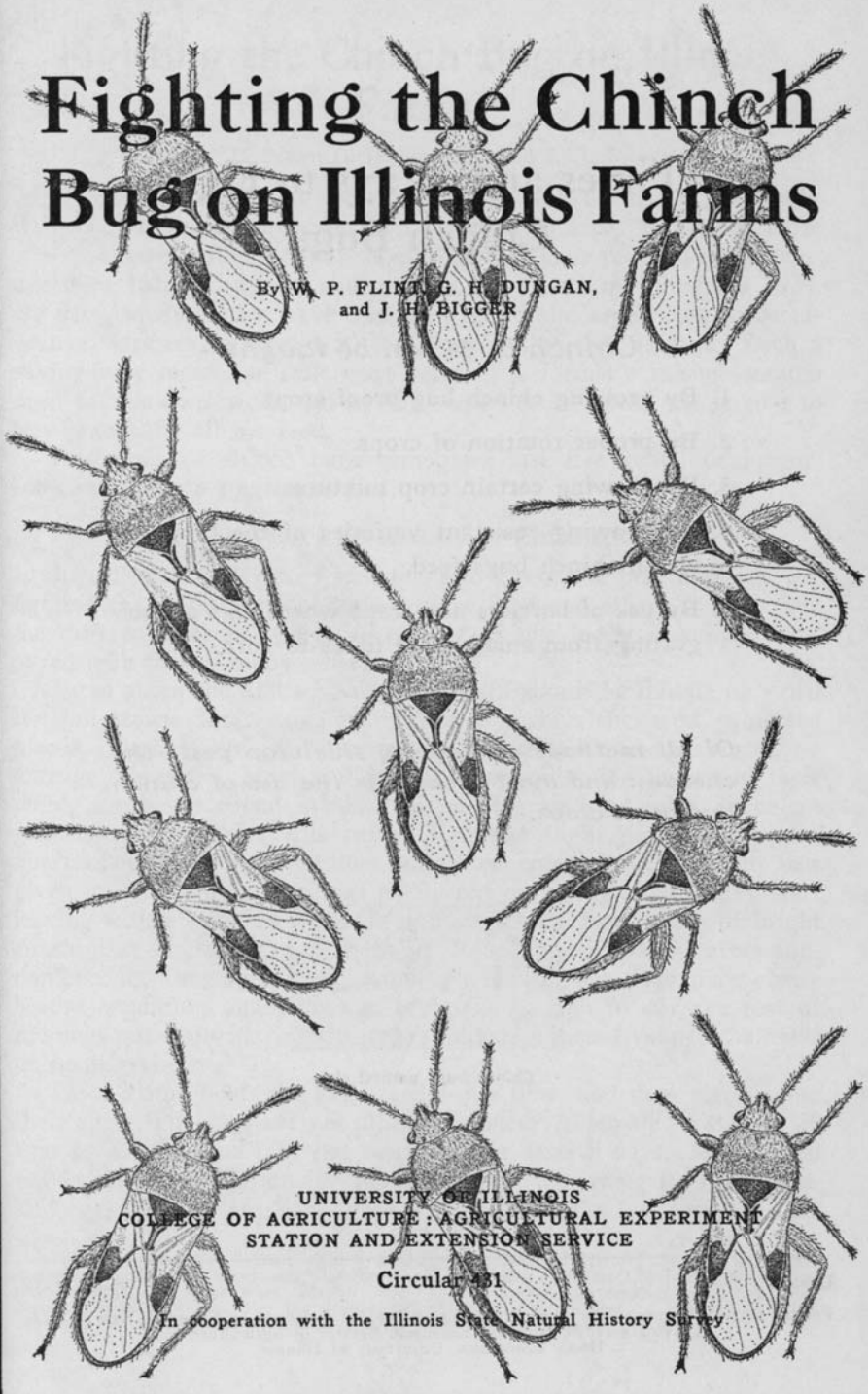
Fighting the Chinch Bug on Illinois Farms

By W. P. FLINT, G. H. DUNGAN, and J. H. BIGGER



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Circular 431

In cooperation with the Illinois State Natural History Survey

Times and Ways to Fight Chinch Bugs

Chinch bugs can be fought--

1. By growing chinch bug proof crops
2. By proper rotation of crops.
3. By growing certain crop mixtures.
4. By growing resistant varieties of the crops on which chinch bugs feed.
5. By use of barriers and traps when bugs are migrating from small grain fields to corn.

Of all methods of fighting this crop pest, the cheapest and most effective is the use of chinch bug proof crops.

Chinch bugs natural size

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Fighting the Chinch Bug on Illinois Farms

By W. P. Flint, G. H. Dungan, and J. H. Bigger[1]

CHINCH BUGS at their worst may, and often do, practically destroy the corn crop over an infested area. A loss of more than 40 million dollars is estimated to have resulted from damage done to corn, wheat, and oats by this insect in Illinois in 1934. By using methods that have been well tested and are known to be effective, farmers can avoid 50 to 75 percent of this damage. Such a saving may mean the difference between a farmer's raising enough feed for his own needs and having some grain to sell, and having to buy practically all his feed.

Outbreaks of chinch bugs sometimes last five years, or longer, sometimes only a single season.

Habits and Life History of Chinch Bug

In order to understand and put into effect the best methods for fighting the chinch bug, one must know how and where it goes thru the different seasons. The life history of this insect is simple compared with that of many others.

From about the first of November until about the middle of April the full-grown chinch bugs are hidden in various sheltered, protected places. They do not feed during this period and consequently do no damage. In April, May, and June, the overwintered bugs and their young are to be found in fields of small grain or tender, succulent grasses. It is during this period that the flight out from winter quarters occurs. This flight does not always come at the same date in a given locality, nor do the bugs all fly out on a single day—they start leaving winter quarters when there have been several hours of bright sunshine at temperatures of about 70° F. or above. If the weather suddenly cools, the flight ceases, and a week or ten days may elapse before conditions again become favorable enough to stir the rest of the bugs out of their winter quarters and start them flying to the fields of small grain.

Once in the fields the bugs feed for a time, and then start laying their eggs. The eggs are not all laid at once. A female lays 15 to 20 eggs in one day and may not lay again for several days. Mating and egg-laying usually go on for about a month, the young from the first-laid eggs often being nearly grown by the time the last eggs are laid.

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Fig. 1.—Where the chinch bug is to be found at different seasons

By the middle of June most of the old bugs are dead. The first-hatched bugs are usually still in the immature stage, that is, they have not yet acquired wings. When the small grain dries up or is cut, they migrate on foot to fields of corn where, in the latter part of June and July, they very shortly acquire wings. A general flight then takes place, and the bugs scatter over the cornfields, usually picking the thinner stands of corn in order to avoid dampness and shade.

During July, August, and September the bugs from the first brood remain in the cornfields, where the second brood is produced. The flight from the cornfields to winter quarters starts about the last of August and is completed during the first part of November or earlier. The second brood develops almost entirely at the expense of the corn.

Thus there are two broods of the bugs most years, one maturing in the small grain during the late spring and the second maturing in the corn during the summer. In very dry, hot years there may be a partial third brood in late summer. For about six months of the year, from about October to April, the adult bugs are in a quiescent, non-feeding stage.

Weather Controlling Factor in Chinch Bug Abundance

Of all the factors affecting the abundance of chinch bugs, weather is by far the most important. Chinch bugs are often said to be dry-weather insects, but much depends on the time of year when the dry weather occurs. Heavy rains in the early spring may have little or no effect on the bugs, but frequent heavy rains during the last half of May and June will reduce infestations, and even in years of greatest abundance will keep down the numbers to a point where no serious damage will occur. The rain beats the young bugs down into the ground and "muds" them in so they die. Also dampness and high humidity are favorable to the spread of the white fungous disease which attacks the insects.

Again, if a period of very wet weather occurs in August, starting about the first of the month and continuing thruout the month, the second brood of chinch bugs will be greatly reduced and usually this means no damage the following year.

Contrary to common belief, winter weather usually has little effect on chinch bugs. Extremely cold weather merely causes them to sleep more soundly. Even 20 degrees below zero will kill few, if any, of the bugs that are protected in their normal winter quarters. Studies covering the last twenty years show that the mortality of the bugs in their winter hibernating quarters runs only from about 6 to 10 percent.

Winter Burning Seldom Pays

If any burning is attempted, care must be taken to prevent the fire doing more harm than good. It is rarely possible to kill more than

50 percent of the bugs sheltering in any given type of cover. Because of the impracticability of burning over all the favored cover in an area as large as a county, or even a township, it is doubtful if more than 25 percent of the bugs in such an area can be killed by winter burning. It may be worth while, however, for the individual farmer, or a small group of farmers, to burn over some roadsides, ditch banks, or hedgerows in which many millions of bugs may be passing the winter.

Favorite Hibernating Places.—From mid-October to mid-April 95 to 100 percent of the chinch bugs are in the adult stage hidden in various types of protective shelter. The favorite shelters are *prairie grass, bunch grass, broom sedge, bluestem,* and other native and cultivated grasses that form dense bunches or clumps. The bugs are especially abundant where these grasses grow on south slopes along roads, south sides of ditch banks and hedges, and the south and west exposures of woodlands. Large numbers occasionally infest other types of shelter—around buildings, under loose bark of trees and posts, in accumulations of some types of trash, and under leaves of mullein and other plants. They rarely penetrate more than 10 or 15 rods into the denser woodlands. Only a comparatively few bugs hibernate in cornstalks.

What Not to Burn.—In burning hibernating quarters in winter, take care not to destroy the natural shelters for birds and other forms of wild life, for these are likely to be of much greater value than the benefit derived from chinch bug destruction. Do not burn well-established stands of bluegrass, because burning old grass greatly retards the rate and reduces the amount of growth made by the new crop of bluegrass.[1] Woodland should never be burned, as the damage done by killing the young growth and destroying wild-life shelters will more than offset the benefit gained.

In short, concentrate on the favored hibernating places and burn those, but do not attempt to burn off the whole countryside, as more harm than good results from indiscriminate general burning.

Immune Crops Best Weapons Against Chinch Bugs

Of all methods of fighting the chinch bug, the cheapest and most effective is the use of crops that are immune to attack. These include such crops as *alfalfa, red clover, sweet clover, alsike clover, lespedeza, cowpeas, soybeans, sunflowers, flax, buckwheat, sugar beets, artichokes, potatoes,* and *rape.*

The chinch bug has never been known to develop on any plant that did not belong to the grass family and, so far as is known, no member

[1]Graber, L. F. Injury from burning off old grass on established bluegrass pastures. Jour. Amer. Soc. Agron. **18**, 815-819. 1926.

of the grass family is chinch bug proof. Fortunately for the farmer not all crops of the grass family are equally favored by the chinch bug. Among the small grains, for instance, *barley* is most liked. It is therefore a hazardous crop in most parts of the state if the bugs are at all numerous. Other small grains ranked in about the order in which the chinch bug chooses them, are: *spring wheat, spelt, wheat, oats,* and *unpastured rye.* Where rye is thinned by pasturing, it will become heavily infested. All grass weeds such as *foxtail, barnyard grass, tickle grass,* and *quack grass* serve as pasture for the chinch bug.

The larger growing grass crops are favored by the chinch bug in the following order: *Sudan grass, millet, corn, sorghum, broomcorn, and grain sorghum.*

A heavy stand of grain of any variety is avoided by the bugs. A dense growth of clover in small grain discourages them and helps to prevent damage.

Crop Rotations to Reduce Damage

As has been stated, the bugs of the first brood depend for their food mainly on small grain, especially *wheat, oats, barley,* and *rye,* and the second brood feeds almost exclusively on *corn.* It naturally follows that a good way to hold this insect in check is to make its food scarce somewhere along the line. This means that wheat-growing areas should cut down on their acreages of corn, substituting, if possible, some crop on which the chinch bug will not feed; and that heavy corn-producing areas should reduce the acreage devoted to small grains. A rotation of corn, soybeans, wheat or oats, and clover will suffer as little loss as any rotation that contains a small grain and corn.

For a farm especially well suited to corn production, the following sequence of crops is suggested:

Corn	20 percent
Soybeans	20 percent
Corn	20 percent
Oats (or wheat)	20 percent
Clover	20 percent

In the corn-belt area it is necessary, in some years and on some farms, to sow oats or wheat next to corn if the rotation is not to be broken. Under such conditions a creosote barrier must be maintained between the small grain and the corn while the chinch bugs are migrating from the small grain. In years when chinch bugs are abundant, soybeans may be planted in corn at the rate of two beans to each hill of corn (see page 10). In such years, strains of corn resistant to second-brood bugs should be planted if possible.

In areas where less corn is needed a rotation of the following type may be used:

Wheat (or oats)	25 percent
Clover	25 percent
Corn	25 percent
Soybeans	25 percent

This rotation is recommended for those farms in the southern three-fifths of the state on which winter wheat is commonly grown and on which the soil is in condition to produce good crops of wheat.

In order to facilitate efforts to control chinch bugs by maintaining proper rotations, neighbors may well cooperate by planting corn in adjoining fields. When both small grains and corn are grown on the same or on adjoining farms, the fields of these two crops should preferably not be adjacent to each other. Small irregular fields should be eliminated wherever possible, as they make control by barriers difficult.

The essential point to observe in arranging a rotation to prevent chinch bug injury is to grow as large an acreage as possible of the crops on which the chinch bug does not feed.

Weather conditions in May and June *may* destroy the chinch bugs, *but this may not happen until after corn planting.*

Some Varieties of Corn Relatively Resistant

Some varieties of corn can withstand the feeding of the second brood of chinch bugs and still produce a reasonably good crop of grain. There is no variety, however, that can withstand the onslaught of a horde of hungry first-brood bugs traveling on foot from adjoining fields of small grains; barriers must be used to protect corn from them.

The particular quality that makes some strains of corn more capable than others of resisting injury from chinch bugs is not known. Under similar conditions there is no appreciable difference between the number of insects on a chinch bug resistant strain and on a chinch bug susceptible strain.

Varieties for Southern Illinois.—Five varieties of corn—*Champion White Pearl* (sometimes called *Democrat*), *Pride of Saline, Golden Beauty, Black Hawk,* and *Mohawk*—have proved resistant to chinch bug damage and are also adapted to the upland soils of southern Illinois. *Moore Yellow Dent,* too, is well adapted to this section of the state, altho it is only slightly resistant to chinch bugs. These varieties have a medium to smoothly indented grain which has a rather hard, flinty endosperm. The kernels of Champion White Pearl and Pride of Saline are pearly white; Black Hawk has a red kernel with a yellow cap; Mohawk varies from white to blue, with many ears bearing both white and blue kernels. The cob of Mohawk may be either white or red; Golden Beauty is a yellow corn having either a white or a red cob; Moore Yellow Dent is a broad kerneled, horny type of yellow corn, having a red cob.

Some new varieties resistant to chinch bug attack have been developed within the last few years. *Waddell Utility White Dent* and *Waddell Utility Yellow Dent* have been produced by Elmer Waddell of Taylorville, Illinois. These varieties have a very good type of grain for livestock feeding, and the plants possess marked resistance to second-brood chinch bugs.

Varieties for Central and Northern Illinois.—Much progress has been made in the development of hybrid corns distinctly resistant to second-brood chinch bugs. The best of these hybrids are much more resistant than the open-pollinated varieties commonly grown in the central and northern parts of the state. When seed of such hybrids is available, it should be used in preference to less-resistant varieties. Some hybrids, however, are distinctly susceptible to chinch bug injury and should be avoided.

When seed of resistant hybrid corn is not available, it is recommended that the best adapted and highest yielding open-pollinated varieties be grown in central and northern Illinois, instead of imported unadapted chinch bug resistant varieties from southern Illinois. Under heavy infestation in central Illinois the southern varieties will stand up better and perhaps yield a little more corn than local varieties, but the growing of southern corns in central Illinois is accompanied by considerable hazard, owing to the fact that these varieties mature late

Fig. 2.—Effect of chinch bugs on nonresistant and resistant strains of corn

The nonresistant hybrid corn shown above on the left was planted on the same day and cultivated in exactly the same manner as the resistant hybrid corn on the right. The second brood of bugs flew into this plot, almost completely destroying one strain but not preventing the other from producing a good yield. (*Courtesy J. R. Holbert, Bureau of Plant Industry, U. S. Department of Agriculture.*)

and, unless planted early on fertile soil, they may be caught by frost in the fall.

Planting Practices Help to Cut Damage

Soybeans of Benefit With Corn.—Planting soybeans in the hill with corn is an effective way to help reduce second-brood chinch bug damage. The soybean plants hold the morning dew and the moisture after rains, thus making an unfavorable environment for the bugs. Soybeans grown with corn reduce the yield of corn under normal conditions, but even in moderate infestations of chinch bugs the harmfulness of the soybeans is not as great as the benefit derived from them.

Planting the corn in hills and using two or three beans to the hill gives better results than drilling.

The planting of any crop such as pumpkins or rape in the corn will also lessen the damage from chinch bugs by providing heavy shade for the lower part of the corn plants.

Grass in Corn Is of Some Benefit.—Weeds of the grass family growing in a cornfield serve to some extent to protect corn plants from chinch bugs. Labor of cultivation may be saved and an increase in the yield of corn be gained by allowing such weeds as foxtail and barnyard grass to grow in the corn, since chinch bugs seem to prefer these grasses to corn. Some men have actually scattered seed of Sudan grass between corn rows at the last cultivation for the protection the Sudan would give the corn. Weeds of other types have no value for this purpose, and withholding the last cultivation to permit smartweed and pigweed to grow will result in reduced corn yields.

Thick Planting of Corn Desirable.—In thickly planted corn chinch bugs do less damage than in thin plantings. In areas where chinch bugs are numerous it is therefore recommended that corn be checked a little thicker than under normal conditions.

Chemicals Recommended for Barriers

Barriers are used to prevent the migration of chinch bugs from fields of small grain or grasses, where the first-brood bugs have hatched, to fields of corn or uninfested small grains. Chemical barriers of either the dirt-ridge creosote or the chemically treated paper strip type have proved both the most effective and the least expensive. Besides stopping the bugs from traveling from one crop to another, these barriers make it possible to trap and kill great numbers of bugs.

The best materials for barriers are those that have a strong odor of creosote, cresylic acid, or naphthalene. These are found in certain grades of *crude creosote, naphthalene, naphthalene drain oils,* and to some extent in *pine-tar oils.* Such barriers are much more lasting and are less affected by blowing dust, rain, and wind than are dusty furrows or road-oil barriers. The odor of these materials is so repellent

that the bugs will turn back before they will cross the barrier. The best oil so far tested has the following specifications:

"The oil shall be a distillate of coal-tar or coke-oven tar. It shall not contain more than 3 percent of water, nor more than .5 percent of matter insoluble in benzol. The specific gravity of the oil at 38° compared with water at 15.5° C. shall be not less than 1.03.

"The distillate, based on water-free oil, shall be within the following limits:

"Up to 210° C. not more than 5 percent.

"Up to 235° C. not more than 25 percent.

"The residue above 355° C., if it exceeds 5 percent, shall have a float test of not more than 50 seconds at 70° C.

"The above test shall be made in accordance with the standard methods of American Wood Preservers' Association.

"Percent tar acids, not less than 2-3.

"Viscosity 45-65 seconds 100° F. Saybolt test."

In ordering creosote for chinch bug barriers it is recommended that the above specifications be used.

Making the Dirt-Ridge Creosote Barrier

Barriers, whether of the dirt-ridge creosote or the paper-strip creosote type, are usually made by throwing up a ridge of earth between the field infested by bugs and the field of corn which is to be protected.

The ridge of earth should be thrown up about two weeks before the small grain is to be harvested. Make the ridge 6 to 8 inches high and as smooth as possible. Leave a flat surface at least 2 inches wide at the brow of the ridge as a location for the creosote line (for particular directions for constructing the paper-strip barrier, see page 13). Constructing the ridge some time before it is to be used permits the dirt to settle and the ridge to become more smooth than one freshly thrown up. This settling and smoothing is quite essential to the success of the barrier.

One of the most common methods for constructing a ridge is to plow a furrow around the field, throwing the dirt toward the corn. Smooth the furrow down with the back of a spade or section of harrow or plank drag. Make the post-hole traps in the bottom of the furrow or partly in the sloping side. When the barrier is prepared in advance, it is an easy matter to apply the creosote as soon as the bugs start to move.

A ridge may also be thrown up with a disk cultivator. Where this is done, the ridge will usually have to be placed between the first and second rows of corn, where the ground has been cultivated, the first row of corn being cut out before the ridge is thrown up. A small road grader is also a very good implement for making a ridge. It makes little difference what implement is used for throwing up the barrier so long as a smooth ridge results.

Placing the Repellent Material.—Always bear in mind that creosote or paper barriers must be placed at *the top* of a ridge or slope. As has been explained, these materials turn the bugs very largely because of their repellent odor. If they are placed at the bottom of a depression, the large numbers of bugs trying to get out of the field force the

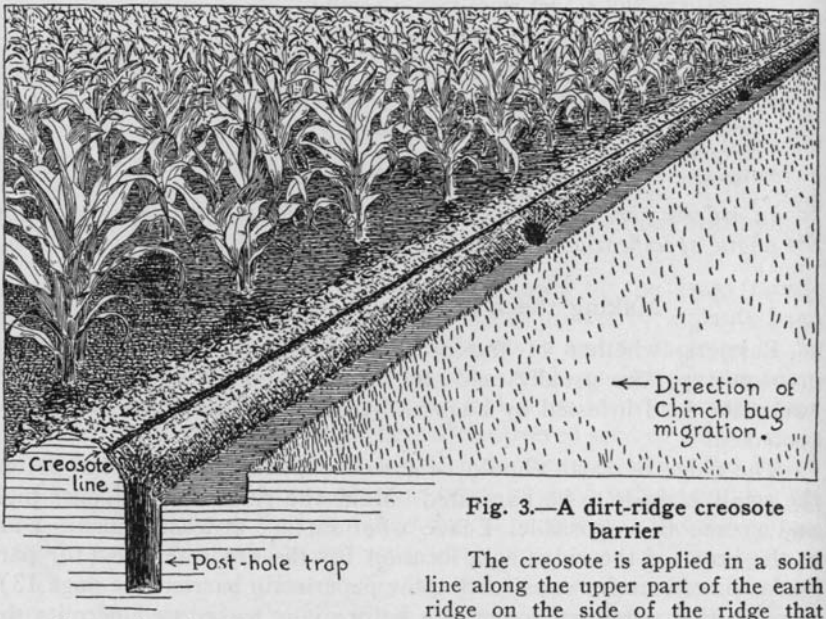

Fig. 3.—A dirt-ridge creosote barrier

The creosote is applied in a solid line along the upper part of the earth ridge on the side of the ridge that faces the small grain. Note that the post-hole traps are in the side of the ridge, not the bottom. The tops of these traps must be kept flared and dusty if they are to catch and hold the bugs.

front line of bugs over the barrier. If the repellent material is placed at the top of the ridge, where the bugs have to climb up to it, they are repelled by the odor before they actually crawl onto the barrier, and they therefore will not be forced upon it by the bugs behind. Another reason for placing the material at the top of the ridge is that fewer bugs will be blown over such a barrier than over one at the bottom of the depression.

Bucket for Applying the Material.—For applying the creosote or other repellent about the best method that has been worked out, considering expense and ease of application, is to punch an 8-penny nail hole in the *side* of a galvanized or tin bucket, placing the hole about an inch from the bottom of the pail directly below the point where the bail attaches. A stream of creosote flowing from such a hole will form

a sufficiently wide path on the barrier ridge to turn the bugs. A half-inch path is wide enough.

All barrier materials will have to be renewed at least once a day for the first several days. In renewing them, try to apply the material on the same path. If this is done with the better barrier materials, complete renewal will be necessary only every other day after several applications have been made, altho the line should be gone over and patched every afternoon between 1:30 and 6 o'clock, as the bugs are more active in the afternoon.

Post-Hole Traps.—To get the best results from a barrier, a line of post holes in which the bugs can be caught and killed must be maintained at the bottom of the barrier. These holes should be about 18 inches deep, and the tops should be flared and kept dusty so that the bugs will fall into them. The dust also makes is impossible for the bugs to obtain a foothold and crawl out of the holes.

The bugs in the holes should be killed every afternoon at about sundown. One of the easiest ways to do this is to pour one to two tablespoonfuls of kerosene into the hole, scattering it around over the bugs. Do not ignite the kerosene—let the bugs work it around among themselves. In this way nearly all the bugs in the hole will be killed. A tablespoonful of calcium cyanide *flakes* (not dust) may be substituted for the kerosene. The only drawback to its use is its expense.

Narrow strips of calcium cyanide flakes placed at right angles to the creosote barrier and at intervals of 1 to 5 rods (depending on number of bugs) will kill the bugs effectively. These strips should be 2 inches wide and 10 to 12 inches long. They must be renewed daily.

Cost of Creosote Barriers on Dirt Ridge.—Thirty-five to 50 gallons of creosote, naphthalene drain oil, or other effective material is usually required for a line a quarter of a mile long. This amount will provide for renewals for as long as a barrier is necessary, which is usually 14 to 18 days.

An acre of corn saved will usually more than pay for the maintenance of a quarter of a mile of barrier. Where the maximum amount of material is used—that is, 50 gallons for 80 rods of line—the material will cost $10 at 20 cents a gallon. The labor cost will be a little more than the cost of materials. If the bugs are really to be stopped, the time of a man or boy will be required for every half-mile of barrier from 1:30 to 6 o'clock every afternoon while the barrier is maintained.

Treated Paper-Strips, an Improved Type of Barrier

A new type of barrier, consisting of chemically treated strips of single-faced corrugated or tar-felt (not asphalt) paper 4 inches wide, buried by half their width in the soil, gave excellent results in 1934 tests.

This paper-barrier method of stopping chinch bugs was also worked out by the Iowa Experiment Station and operated by them in the field to a small extent last year (1934). It appears to be a distinct improvement over the ordinary dirt-ridge method in that it is less expensive and traps a higher percentage of bugs.

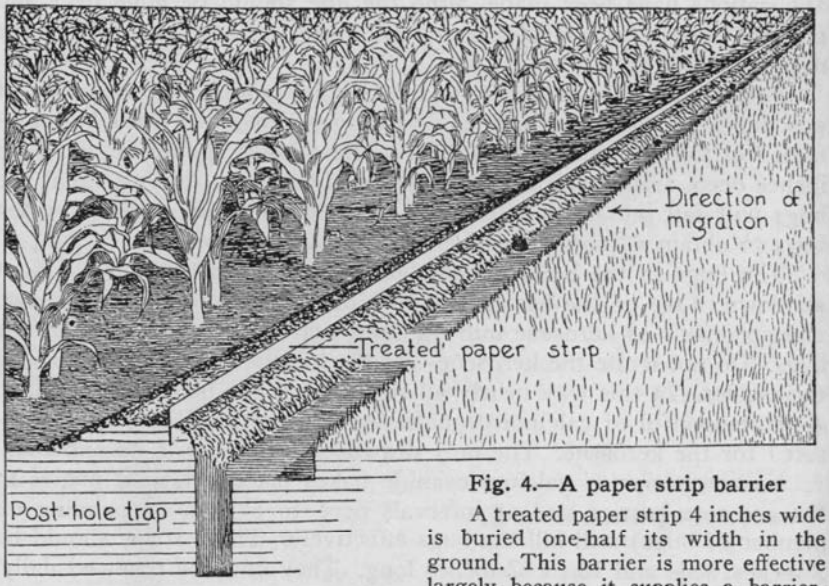

Fig. 4.—A paper strip barrier

A treated paper strip 4 inches wide is buried one-half its width in the ground. This barrier is more effective largely because it supplies a barrier-wall as an obstacle in addition to the dirt ridge and repellent odor. It is the most effective and economical method as yet devised for cutting off first-brood chinch bugs between small grain fields and corn.

Corrugated paper or tar-felt paper may be bought in rolls from the lumber yard and sawed into 4-inch strips with a hand or crosscut saw. This is a somewhat tedious task and will require the use of a considerable amount of oil and "elbow grease" on the part of the person doing the sawing. The strips are then soaked at least one hour in chinch bug creosote or melted naphthalene. This year (1935) a number of manufacturers will have on the market paper already saturated with melted naphthalene or creosote. The chemical on the barrier will have to be renewed after one to two days.

Constructing the Barrier.—First throw up a ridge of dirt, as explained on page 11. Then make a narrow furrow or trench along the brow of the ridge using a disk cultivator, a shovel cultivator with all but one shovel removed, a hoe, a garden cultivator, or any other similar implement. Place the paper strips in this furrow so that 2 inches of the treated paper projects above the top of the ground.

Firmly tamp the soil around the base of the paper. Post holes are necessary for the effective working of paper barriers just as they are for the creosote dirt barrier. (For directions concerning the placing of post holes and the treatment of trapped bugs, see page 13.)

Two men can erect a paper barrier a quarter of a mile long in three to four hours. The treated paper comes in strips 150 to 250 feet long. Nine strips of the 150-foot lengths are required for a quarter of a mile of barrier, and six strips of the 250-foot lengths are required for about the same distance.

Maintaining the Barrier.—Once the paper is in place it should repel the bugs for two or three days if it has been properly treated. Then it will have to be freshened by the addition of more creosote. This should be done by applying the creosote to the top edge of the paper on the side towards which the bugs are coming. A hole in the side of the bucket, the same as is used for applying the creosote barrier to the dirt ridge (page 12), will be effective for this purpose, or a tube may be soldered to the side of the bucket to make the application easier. Two or three gallons of creosote are required to renew the paper treatment for a quarter of a mile. After the paper has been re-treated several times, it will remain effective for two or three days before another renewal is necessary, unless the temperature is very high. This is an advantage over the dirt barrier, which requires more frequent treatment.

Cost of Treated Paper Barriers.—Judging by experimental work in Illinois the past year, not over 30 gallons of creosote will ordinarily be required to maintain a quarter of a mile of paper-strip barrier for the season. This is about two-thirds of the amount required for the dirt ridge. Untreated paper strips cost approximately $2 for each quarter-mile of 4-inch barrier. The cost, at 20 cents a gallon of creosote, would thus be $6 plus $2—a total of $8 per quarter-mile.

Advantages of Treated Paper Barriers.—Paper-strip barriers hold advantages over ordinary creosote dirt barriers in several respects: they are more effective, somewhat cheaper, and require less frequent attention in operation. Paper barriers are more effective largely because they supply a barrier-wall as an obstacle in addition to the dirt ridge and repellent odor. The 2-inch barrier-wall prevents to a greater extent bugs beings blown over the line on windy days, and causes the barrier to be less easily bridged by sticks, straws, or leaves. Consequently it turns back a higher percentage of bugs. That the paper barriers are cheaper is indicated by the estimated cost of $8 per quarter-mile for materials compared with $10 for the creosote-dirt barrier. Finally, paper barriers are maintained with less trouble: while the ordinary creosote-dirt barrier requires renewal of creosote daily for the first several days and every other day thereafter, the paper barrier remains effective for two or three days between re-

newals *from the beginning,* except during periods of extremely high temperature.

When all of these factors are taken into consideration, it is evident that the paper-strip barrier offers the most effective and economical method as yet devised for cutting off first-brood chinch bugs between small grain fields and corn.

Spraying or Dusting Practical on Small Scale Only

Where chinch bugs are gathered in large numbers on the outer rows of corn, sprays may profitably be used for killing the bugs. One of the most efficient sprays is made by using half an ounce of 40-percent nicotine sulfate in 1 gallon of water in which 1 ounce of any good laundry soap has been dissolved. This spray will kill all bugs that are wet by it, and it is not injurious to the corn unless applied in considerable amounts to the curl of the plant.

For larger quantities of spray, use 1 quart of nicotine sulfate (40 percent) to 50 gallons of water in which 3 pounds of laundry or potash fish-oil soap has been dissolved.

Spraying is not practical on a field scale, as it will cost from $20 to $30 an acre.

Poison dusts that kill by contact with bugs may sometimes be used instead of spraying. A dust containing 2.4 percent nicotine will not injure corn plants and is quite effective in killing the bugs hit by it. This dust can be purchased, or can be made by thoroly mixing in a closed container 47 pounds of hydrated lime with 3 pounds of 40-percent nicotine sulfate. The dust must be kept tightly covered until used.

Natural Enemies of Chinch Bugs

A white fungous disease attacks chinch bugs during rainy or damp weather. Little, if anything, can be gained by artificial dissemination of the spores of this fungus, for they are practically always present in the fields and infect many other insects also. When weather conditions are right, the bugs become naturally infected.

Chinch Bugs Lower Quality of Silage and Grains

Corn used for silage is often literally covered with bugs when it is cut. After standing two or three weeks the silage loses the chinch bug odor and apparently is just as palatable to cattle as corn not so infested. No ill effects have been reported from feeding this material.

Chinch bugs reduce the quality of corn as well as yield, the percentage of sound corn being much lower in infested fields.

Where very abundant, chinch bugs are likely to destroy thin stands of small grain, especially barley and spring wheat. Where the grain is not destroyed, the yield and quality are often greatly reduced.

15M—3-35—7345
2M—6-35—7937
5M—2-36—9181