CIHM
Microfiche
Series
(Monographs)

ICMH
Collection de
microfiches
(monographies)

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1997

Technical and Bibliographic Notes / Notes techniques et bibliographiques

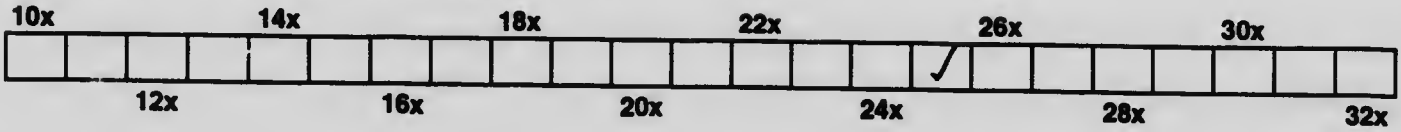
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- ☐ Coloured covers / Couverture de couleur
- ☐ Covers damaged / Couverture endommagée
- ☐ Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- ☐ Cover title missing / Le titre de couverture manque
- ☐ Coloured maps / Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- ☐ Bound with other material / Relié avec d'autres documents
- ☐ Only edition available / Seule édition disponible
- ☐ Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- ☐ Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- ☐ Additional comments / Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured pages / Pages de couleur
- ☐ Pages damaged / Pages endommagées
- ☐ Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- ☐ Pages detached / Pages détachées
- ☑ Showthrough / Transparence
- ☐ Quality of print varies / Qualité inégale de l'impression
- ☐ Includes supplementary material / Comprend du matériel supplémentaire
- ☐ Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- ☐ Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below / Ce document est filmé au taux de réduction indiqué ci-dessous.



The copy filmed here has been reproduced thanks to the generosity of:

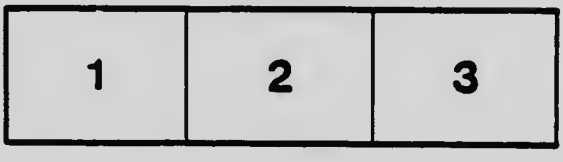
Library
Agriculture Canada

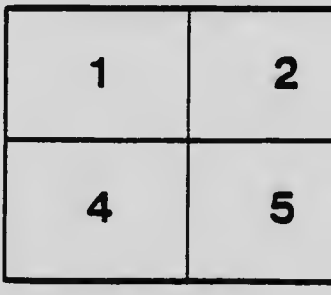
The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol ⟶ (meaning "CONTINUED"), or the symbol ▽ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:





L'exemplaire filmé fut reproduit grâce à la générosité de:

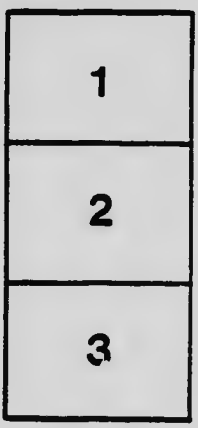
Bibliothèque
Agriculture Canada

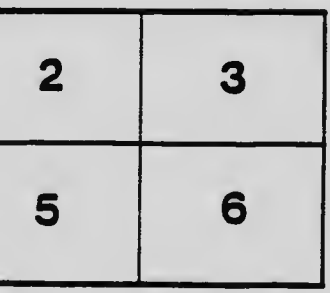
Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole ⟶ signifie "A SUIVRE", le symbole ▽ signifie "FIN".

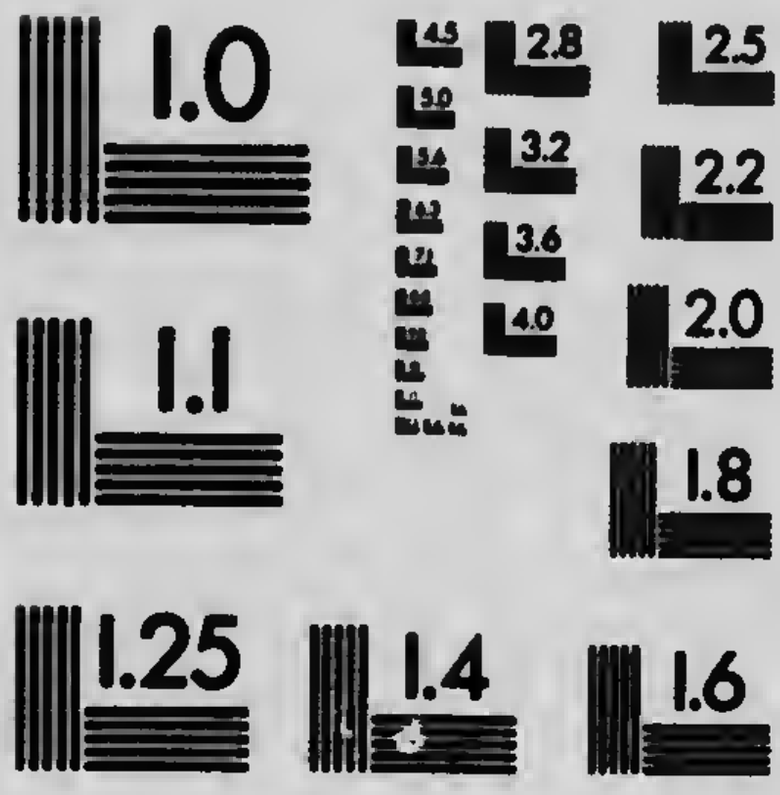
Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.





MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

PROPERTY OF LIBRARY
DEPARTMENT OF AGRICULTURE, OTTAWA
Lent to Ernest St. Maston
Date Sept 9 21 PLEASE RETURN
22606

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

ENTOMOLOGICAL BRANCH

THE CONTROL OF LOCUSTS

IN

EASTERN CANADA

BY

ARTHUR GIBSON,

Chief Assistant Entomologist.

CIRCULAR No. 5.

Published by authority of Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, Ont.

OTTAWA
GOVERNMENT PRINTING BUREAU
1915

75245

632.T04
G42

NOTE.

All inquiries relating to insect pests, and packages (up to 12 ounces in weight) containing specimens may be mailed "Free" if addressed to the Dominion Entomologist, Department of Agriculture, Ottawa.

In all cases where it is possible, living specimens of the insects should be sent enclosed in a strong wooden or tin box to prevent damage in transit. Living insects should be supplied with a liberal quantity of their food plant, and in all cases they should be carefully packed.

The name and address of the sender should be written on the outside of the package, and a letter giving as full details as possible should in all cases accompany insects sent in for report.

The Control of Locusts in Eastern Canada.

By Arthur Gibson, *Chief Assistant Entomologist.*

Locusts, or "grasshoppers" as they are more generally spoken of, have long been known to devastate crops of various kinds in Eastern Canada. During the years 1912, 1913 and 1914, they were extremely numerous and destructive in the provinces of Ontario and Quebec. One correspondent in Lanark county, Ont., reported that crops in his district alone had been destroyed to the extent of 75 per cent, the loss being estimated at $6,000. In many instances, fields of oats and barley were cut green to save for feed. In some parts of the province of Quebec, farms have been abandoned within the years mentioned owing to the large numbers of locusts present.

Fig. 1.—Egg pod of locust opened to show arrangement of eggs; individual eggs at side.—natural size. (Original).

The locusts are true biting insects and feed actively throughout all their stages after hatching from the eggs. The latter are deposited freely in packets or pods, as shown in fig. 1, chiefly in old, neglected pasture lands, and along roadsides, etc., in spots where the soil is dry and largely free of vegetation. The number of eggs in each pod varies with the species. Some pods contain only 10 eggs while others contain as many as 70. They are deposited in late summer and in autumn, the young locusts not hatching until about May of the following year.

The crops attacked by these insects are oats, barley, timothy, rye, wheat, buckwheat, corn, turnip, rape, clover, potato, cabbage, onion, bean, carrot, etc.

THE DESTRUCTIVE SPECIES.

The species of locusts which have been chiefly responsible for damage to crops in Eastern Canada are four in number, as follows:—

The Lesser Migratory Locust, (*Melanoplus atlanis* Riley). This species is the most regularly-occurring destructive locust in Canada. It is found commonly from British Columbia to Nova Scotia. It is shown natural size in figure 3.

THE RED-LEGGED LOCUST, (*Melanoplus femur-rubrum* DeG.), is very similar in size and general colour and markings to the Lesser Migratory Locust. It, also, has a wide distribution in Canada.

Fig. 2.—Locust ovipositing; egg pod in ground at right—enlarged one-half. (Original).

THE PELLUCID LOCUST, (*Camnula pellucida* Scudd.), occurs very often with the Lesser Migratory Locust. The females are larger than those of the latter species, but the males are of about the same size. It has conspicuous blackish spots on the wing-covers and near the upper edge of each wing-cover is a pale-coloured longitudinal stripe.

THE TWO-STRIPED LOCUST, (*Melanoplus bivittatus* Say), is of a yellowish-green colour, varying to dull brown, with two distinct longitudinal stripes (one on either side) from the head to the end of the wing-covers. The females are large and heavy-bodied.

Fig. 3.—The Lesser Migratory Locust, *Melanoplus atlanis* Riley: *a*, adult male; *b*, adult female; *c*, *d*, young hoppers. (Original).

METHODS OF CONTROL.

Poisoned Bran.—During 1914 we had an opportunity of testing out on a fairly large scale the value in Eastern Canada of the Kansas formula for the destruction of locusts.* This formula, which was originally experimented with by Mr. F. B. Milliken when employed by the Kansas Experiment Station consists of

Bran	20 pounds.
Paris green or white arsenic	1 pound
Molasses	2 quarts
Oranges or lemons	3 fruits
Water	3½ gallons.

*The species chiefly responsible for the destruction to crops was the Lesser Migratory Locust, *Melanoplus atlanis*. Associated with it, however, to a comparatively slight extent was the Pellucid Locust, *Camnula pellucida*.

In preparing the bran mash, the bran and Paris green, or white arsenic, are mixed thoroughly while dry. The juices of the oranges or lemons are squeezed into the water, and to this is also added the pulp and peel after cutting into fine bits. The molasses should then be added, and when dissolved the mixture should be poured onto the dry bran and poison, stirring the whole constantly so as to dampen the bran thoroughly.

Fig. 4.—Individual plants of barley and oats showing destruction caused by locusts. (Original).

The results of the experiments conducted in Kansas showed conclusively that the addition of the fruit—oranges or lemons— made the bait more attractive

and appetizing and consequently was eaten by more of the locusts. Professor Geo. A. Dean, Entomologist, Kansas State Agricultural College and Experiment Station, referring to the application of the mixture states: "The damp mash, or bait, should be sown broadcast in the infested areas early in the morning, or about the time the grasshoppers are beginning to move about from their night's rest. It should be scattered in such a manner as to cover five acres with the amount of bait made by using the quantities of ingredients given in the above formula. Since very little of the bran is eaten after it becomes dry, scattering it broadcast in the morning, and very thinly, places it where the largest number will find it in the shortest time. Sowing it in this manner also makes it impossible for birds, barnyard fowls, or live stock to secure a sufficient amount of the poison to kill them. Inasmuch as the poisoned bait does not act quickly, it will be from two to four days before the grasshoppers are found dead, and these will be more numerous in the sheltered places. It does not require much of the poison to kill them. Even a small portion from one of the poisoned flakes will be sufficient to cause death."

In view of the remarkable success in Kansas in the control of locusts, by adding to the poisoned bran the juice of lemons or oranges, the Entomological Branch decided to test out this remedy, near Ottawa, and also to experiment with other mixtures. These experiments were conducted at Bowesville, Ont., where a fairly large section of the country has been badly infested with these insects since 1912. The results obtained were, indeed, very promising and would indicate that the Kansas formula, particularly when lemons are used, will be found of equal value in Canada, at least in the provinces of Ontario and Quebec. In addition to the Bowesville experiments, applications were also made, under our direction, in the province of Quebec, near St. Etienne de Grés, St. Maurice county, where locusts have been extremely destructive.

In the Bowesville experiments the applications were made about the beginning of the last week in June. The locusts were very numerous and only a few, comparatively, had wings. The mixture was broadcasted early in the morning and counts of the locusts killed were made four days later. These gave from 50 to 414 dead locusts to the square yard.

As a result of these experiments Mr. W. D. Jackson, the District Representative of the Ontario Department of Agriculture for Carleton county, arranged to supply bran, molasses, Paris green and lemons—sufficient to treat 400 acres—to the farmers in the immediate district where the locusts were abundant. On June 30, accompanied by Mr. Jackson and his assistant, Mr. Waterman, five farms were visited where it had been decided to apply the mixture. At this time the locusts were mostly in the winged condition, although a number were still in the hopping stage. Within a week after the application counts were made diagonally across oat fields, etc., and these gave from 13 to 124 dead locusts to the square yard, the average being 57. The farmers of the district reported later that they were well pleased with the results of the experiment.

In addition to the Bowesville experiment, at our request, the Rev. J. I Trudel and Rev. E. Fusey arranged to treat fields in their parishes, St. Etienne de Grés and Valmont, Que., and this province even better results were obtained with the Kansas formula. Some farmers used lemons, and some oranges, and a stronger strength of Paris green was used, namely, 1½ pounds to the 20 pounds of bran. The Rev. J. I. Trudel reports that 8 days after the poisoned bran was broadcasted counts were made in various fields and these gave from 900 to 1,200 dead locusts to the square yard. These results are certainly very remarkable and indicate the extraordinary abundance of locusts in that district. At the time of the applications the locusts had their wings and were migrating from one place to another.

As regards the cost of applying this new poisoned bran mixture, the following are the figures for the Bowesville experiments: 100 pounds of bran, $1.25; 5 pounds of Paris green, $1.25; 2 gallons molasses, $1.00; 15 lemons, $0.30;

labour, 6 hours, $1.20; total, $5.00. Applying 20 pounds of the bran so as to treat 4 acres, the cost comes to 25 cents per acre. At St. Etienne des Grés, the cost was found to be about 18 cents per acre, exclusive of labour, and in western Ontario one correspondent reported that the cost was about 20 cents per acre.

The preparation of the mixture at Bowesville, on most farms, was carried out on a cement floor in an outbuilding. The bran was simply placed on the floor and the Paris green mixed in by means of an ordinary garden hoe, after which the fluids were added and the whole kept constantly stirred by the hoe until all the bran was thoroughly dampened. Any vessel or floor used in the mixing of the formula should be thoroughly cleaned afterwards in order to prevent all possible danger of poisoning to live stock.

Fig. 5.—Oat field, Bowesville, Ont., showing injur · locusts. (Original).

In treating large areas with such a mixture it is of the utmost importance in order to secure the results desired—that is, the destruction of a very large percentage of the locusts—to make the application while the insects are in the hopping stage and before they begin to migrate. Farmers should make special arrangements to co-operate and apply the mixture at the same time. This was done in Kansas, and as a result, from 60 to 80 per cent of the insects were destroyed. Prof. Dean states: "The remaining grasshoppers were so left to the mercy of the parasitic and predaceous enemies that only a few of them escaped."

The Criddle Mixture.—This mixture, which has controlled outbreaks of locusts in certain parts of Manitoba but which has not given the same results in Eastern Canada, was given a trial at Bowesville, Ont., in 1914. Four days after the application counts were made in various parts of the field and these averaged 50 dead locusts to the square yard. The Criddle Mixture is made by adding one pound of Paris green and one pound of salt to 15 gallons by measure of fresh horse droppings. Sufficient water should be added to the droppings to make a moist, but not sloppy, mash, and the Paris green and salt then added and thoroughly mixed by means of a fork rake. The mixture may be scattered lightly from a low barrel, box or tub, by means of a trowel or shingle, in the infested fields, chiefly where the insects are feeding.

Referring to the value of this mixture in the province of Manitoba, Mr. Norman Criddle, who devised it, says:—

"There is no doubt whatever as to the remarkable attractiveness of this mixture at all periods, from the time of the locusts' appearance in May until they die in September, or of its superiority over any other form of extermination yet tried in these parts. The evidence of farmers is almost unanimous on this point, and all the best type of men speak with enthusiasim of its value, the few exceptions being due to faulty methods in its application and mixture. My brothers and I have used it continuously for the last ten years with perfect success and at very small cost, the last occasion being in 1913, when we undoubtedly saved many acres of crop, while on more than one occasion its use undoubtedly saved the whole crop as was shown by the destruction of crops on neighboring farms not treated."

Fig. 6.—Field of corn largely destroyed by locusts, Bowesville, Ont. (Original).

Ploughing.—Old pasture land or other areas known to attract locusts for the purpose of egg-laying should be ploughed to a depth of at least six inches after the eggs have been deposited. Egg-laying takes place in late summer and early autumn and the ploughing therefore, should be done in late autumn or in spring before May of the following year, in order that as many eggs as possible will be burried deeply, thus preventing the young escaping to the surface. If the ploughing is done in spring it is wise to follow this immediately by harrowing. Shallow ploughing, which would undoubtedly break up many of the egg pods, would not, however, be thorough enough, so is not to be recommended.